

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

NL Industries/Taracorp
Granite City, Illinois

STATEMENT OF BASIS AND PURPOSE

This decision document represents the selected remedial action for the NL Industries/Taracorp (NL) site developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

This decision is based upon the contents of the administrative record for the NL site. The attached index identifies the items which comprise the administrative record upon which the selection of a remedial action is based.

The State of Illinois has concurred on the selected remedy. The letter of concurrence is attached.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE REMEDY

This final remedy includes treatment of the principal threats posed by the site by (1) removing crushed hard rubber battery casings and lead contaminated soil from residential areas, 2) consolidating the soils, crushed casings and lead-contaminated materials from an adjacent waste pile into the existing Taracorp slag pile and 3) providing the expanded Taracorp pile with a RCRA-compliant, multimedia cap.

The major components of the selected remedy include:

- Installation of an upgraded security fence around the expanded Taracorp pile.
- Deed Restrictions and other institutional controls to ensure protection of the Taracorp pile.
- Performance of soil lead sampling to determine which areas must be excavated and the extent of the excavation.
- Inspection of alleys and driveways and areas containing surficial battery case material in Venice, Eagle Park Acres, Granite City, Madison and any other nearby communities to determine whether additional areas not identified in the Feasibility Study must be remediated as described below.

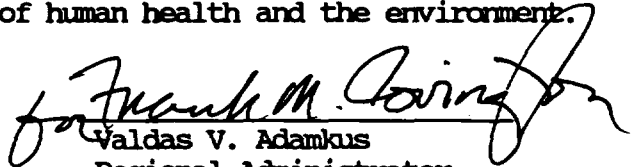
- Performance of blood lead sampling to provide the community with current data on potential acute health effects associated with site contamination.
- Installation of a minimum of one upgradient and three downgradient deep wells, monitoring of groundwater and air, and inspection and maintenance of the cap.
- Removal and recovery of all drums on the Taracorp pile at a secondary lead smelter.
- Consolidation of waste contained in an adjacent St. Louis Lead Recyclers piles with the Taracorp pile.
- Excavation and consolidation with the Taracorp pile or off-site disposal of battery case material from all applicable alleys and driveways in Venice, Illinois, Eagle Park Acres, and any other nearby communities.
- Excavation and consolidation with the Taracorp pile of all unpaved portions of adjacent Area 1 (see Figure) with lead concentrations greater than 1000 ppm.
- Excavation and consolidation with Taracorp pile or off-site disposal of all residential soils and battery case materials around the site and in Venice, Eagle Park Acres, and any other nearby communities with lead concentrations greater than 500 ppm.
- Inspection of the interiors of homes on property to be excavated to identify possible additional sources of lead exposure and recommend appropriate actions to minimize exposure.
- Implementation of dust control measures during all remedial construction activities.
- Construction of a RCRA-compliant, multi-media cap over the expanded Taracorp pile and a clay liner under all newly-created portions of the expanded Taracorp pile.
- Development of contingency plans to provide remedial action in the event that the concentration of contaminants in groundwater or lead or PM_{10} (particulate matter greater than 10 microns) in air exceed applicable standards or established action levels, or that waste materials or soils have become releasable to the air in the future.
- Development of contingency measures to provide for sampling and removal of any soils within the zone of contamination described by the soil lead sampling to be implemented above with lead concentrations above 500 ppm which are presently capped by asphalt or other barriers but become exposed in the future due to land use changes or deterioration of the existing use.

DECLARATION

The selected remedy is protective of human health and the environment, attains Federal and State requirements that are applicable or relevant and appropriate, and is cost-effective. This remedy satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this site.

However, because this remedy will result in hazardous substances remaining on-site above health-based levels, a review will be conducted every five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

3/30/90
Date


Valdas V. Adamkus
Regional Administrator
Region V

ADMINISTRATIVE RECORD INDEX

NL INDUSTRIES/TARACORP
GRANITE CITY, ILLINOIS SITE

	<u>DATE</u>	<u>TITLE / DOCUMENT TYPE</u>	<u>AUTHOR</u>	<u>CONTENTS</u>	<u>PAGES</u>
1.	3/11/85	RI/FS Consent Order	N/A	Same as Title	48
2.	Various	Access File	N/A	RI Access Agreements and Summaries	78
3.	Various	Access File	N/A	RI-Phase II Access Agreements	8
4.	May 1986	"RI/FS Work Plan"	O'Brien & Gere	RI/Fs Work Plan/ QAPP/Safety Plan	1
5.	5/6/87	Memo to Jerri Garl, U.S. EPA	Brad Bradley, U.S. EPA	Request for review of well locations	6
6.	5/20/87	RI Preliminary Results	O'Brien & Gere	Same as Title	25
7.	5/26/87	Letter to Brad Bradley	Ken Miller, IEPA	IEPA Comments on RI/FS Work Plan Addendum	4
8.	6/16/87	Letter to Stephen Holt, NL Industries	Brad Bradley	U.S. EPA request for and comments on Work Plan Addendum	3
9.	7/10/87	Revised Work Plan Addendum	Stephen Holt, NL Industries	Same as Title	8
10.	September 1988	"RI Report"	O'Brien & Gere	Same as Title	405
11.	1/10/89	RI Report Addendum	Brad Bradley	Letter approving and stating necessary changes to RI Report	5
12.	2/8/89	Meeting Notes	Brad Bradley/ O'Brien & Gere	NL Presentation of Remedial Response Objectives at meeting	7
13.	April 1989	"Alternatives Development Report"	O'Brien & Gere	Alternatives Array for the site	84

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14.	7/15/85	Letter to W.K. Weddendorf, NL Industries	John Hooker, IEPA	Comments on RI/FS Work Plan, Safety Plan	2
15.	7/24/85	Letter to W.K. Weddendorf, NL Industries	John Hooker, IEPA	Comments on QAPP	2
16.	7/30/85	Letter to W.K. Weddendorf, NL Industries	Neil Meldgin, U.S. EPA	Comments on RI/FS Work Plan	1
17.	8/19/85	Letter to W.K. Weddendorf, NL Industries	Neil Meldgin, U.S. EPA	Comments on QAPP	6
18.	8/23/85	Letter to Frank Hale, OB & G	W.K. Weddendorf	Transmittal letter of U.S. EPA and IEPA RI/FS Work Plan and QAPP Comments	13
19.	10/21/85	Letter to U.S. EPA and IEPA	W.K. Weddendorf	Response to U.S. EPA and IEPA RI/FS Work Plan and QAPP comments	21
20.	10/24/85	Letter to Frank Hale	W.K. Weddendorf	RI Soil Sampling Program Discussion	4
21.	11/25/85	Letter to W.K. Weddendorf	John Hooker	RI/FS Work Plan, QAPP Safety Plan Comments.	2
22.	12/11/85	Letter to W.K. Weddendorf	Brad Bradley	RI/FS Work Plan Safety Plan Comments	2
23.	12/17/85	Letter to W.K. Weddendorf	Brad Bradley	RI/FS Work Plan Safety Plan Comments	4
24.	12/20/85	Letter to Brad Bradley	John Hooker	RI Sampling Parameters	2
25.	1/14/86	Letter to U.S. EPA and IEPA	W.K. Weddendorf	RI/FS Work Plan Comment Timeframes	2
26.	2/4/85	Letter to U.S. EPA and IEPA	W.K. Weddendorf	Response to U.S. EPA and IEPA comments on RI/FS Work Plan	23
27.	5/6/86	Memo to file	Brad Bradley	Summary of 2/27/86 meeting between U.S. EPA/IEPA/NL Industries	3

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28.	3/4/86	Letter to Brad Bradley	Ken Miller, IEPA	Revised RI/FS Work Plan Comments	2
29.	3/24/86	Letter to Frank Hale	W.K. Weddendorf	Summary of changes necessitated by 2/27/86 meeting	2
30.	5/12/86	Memo to file	Brad Bradley	Summary of U.S. EPA/IEPA/NL Industries 4/9/86 QAPP Conference Call	19
31.	4/15/86	Letter to W.K. Weddendorf	Brad Bradley	Approval to commence RI Tasks 1 and 2	1
32.	6/26/86	Letter to Stephen Holt, NL Industries	Ken Miller	Comment on May 1986 RI/FS Work Plan	4
33.	7/30/86	Letter to Stephen Holt	Brad Bradley	Approval of May 1986 RI/FS Work Plan	11
34.	8/29/86	Letter to David Hill, O'Brien & Gere	David Payne, U.S. EPA	Requirements for QA Performance Evaluation Samples	1
35.	11/4/86	Letter to U.S. EPA and IEPA	Stephen Holt	RI Field Work Time Frames	2
36.	12/15/86	Letter responding to Holt's 11/4/86 letter	Brad Bradley	Same as Title	1
37.	4/9/87	Letter to Stephen Holt	Brad Bradley	Parameters to be analyzed for in groundwater in 2nd Quarter for RI	2
38.	4/24/87	Letter to Stephen Holt	Ken Miller	Data Reporting Requirements for RI Samples	2
39.	10/30/87	Letter to Stephen Holt	Brad Bradley	Approval for RI/FS Work Plan Addendum	1
40.	12/30/86	Memo to Norman Niedergang, U.S. EPA	David Payne, U.S. EPA	Performance Evaluation Sample Analysis	4
41.	3/11/88	Letter to Stephen Holt	Brad Bradley	Comments on Draft RI Report	43

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42.	5/20/88	Letter to Stephen Holt	Brad Bradley	Timeframes for additional	3
43.	5/27/88	Letter to Stephen Holt	Frank Hale	RI Soil Analyses Analysis of Additional Soil Samples	2
44.	6/6/88	Letter to U.S. EPA and IEPA	Stephen Holt	Soil Analysis and Final RI Report Time Frames	2
45.	8/18/88	Letter to U.S. EPA and IEPA	Frank Hale	Draft RI Report Risk Assessment Defense	5
46.	8/18/88	Letter to U.S. EPA and IEPA	Frank Hale	RI QA Data Review Comments	3
47.	8/24/88	Letter to Stephen Holt	Brad Bradley	Final RI Report Submission Schedule Approval	1
48.	9/7/88	Letter to Frank Hale	Brad Bradley	Risk Assessment Criticism Letter	3
49.	11/4/88	Letter to Stephen Holt	Brad Bradley	Necessary Changes to Final RI Report	3
50.	11/30/88	Letter to U.S. EPA IEPA	Stephen Holt	Time Frame for NL Industries Response to 11/4/88 Bradley letter	2
51.	12/14/88	Letter to Brad Bradley	Bonni Kaufman Donovan, Leisure, Newton & Irvine	Time Frames for NL Industries Response to 11/4/88 Bradley letter	1
52.	12/16/88	Letter to U.S. EPA and IEPA	Bonni Kaufman Donovan, Leisure Newton & Irvine	NL Industries Response to 11/4/88 Bradley letter	23
53.	12/16/88	Letter to Brad Bradley	Ken Miller	IEPA Comments on U.S. EPA Procedures for Finalizing RI Report	2
54.	2/1/89	Letter to Stephen Holt	Brad Bradley	Final Agency Action on Final RI Report	6
55.	6/23/89	Letter to Stephen Holt	Brad Bradley	Comments on Alternatives Array Document	4

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56.	10/26/89	Letter to Stephen Holt	Frank Hale	Areas Targeted for Remediation	3
57.	Various	Bi-Monthly Progress Reports	Stephen Holt	Same as Title	66
58.	5/28/85	Letter to U.S. EPA and IEPA	W.K. Weddendorf	Statement of NL Industries Project Coordinator	2
59.	4/13/89	"Cincinnati Soil Lead Demonstration Project"	University of Cincinnati	Same as Title	174
60.	April 1983	"Study of Lead Pollution in Granite City, Madison and Venice, Illinois"	IEPA	Same as Title	52
61.	September 1984	"A Land Pollution Assessment of Granite City/Taracorp Industries"	IEPA	Same as Title	64
62.	7/16/86	Letter to Frank Hale	Robert Crawford, Galena Industries	Lead Recovery Method	6
63.	2/10/87	Letter to Steve Holt	Ken Miller	Monitoring Well Boring Logs	25
64.	2/24/87	Letter to Sue Doubet, IEPA	John Coniglio, Envirodyne Engineers	RI groundwater Duplicate Sample Date	12
65.	6/12/86	Marble Lead Works Preliminary Assessment	Richard Lange, IEPA	Same as Title	18
66.	4/26/88	Letter to Stephen Holt	Ken Miller	Transmittal of Illinois Dept. of Public Health Soil Sampling Results and Lead health effects papers	160
67.	4/25/88	Letter to Brad Bradley	Ken Miller	Transmittal of Illinois Water Survey Data on Wells near the site	12

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68.	1/18/89	"Preliminary Health Assessment for NL Industries/Taracorp Lead Site"	Agency for Toxic Substances and Disease Registry	Same as Title	6
69.	9/7/89	"Interim Guidance on Establishing soil Lead Cleanup levels at Superfund Sites"	Henry Longest U.S. EPA	Same as Title	3
70.	October 1989	"International Lead Zinc Research Organization Environmental Report"	Same as Title	Same as Title	3
71.	5/13/85	Letter to Stanton Sobel, Taracorp, Inc.	W.K. Weddendorf	File Request	2
72.	3/5/87	Letter to Stephen Holt	Basil Constantelos, U.S. EPA	SARA Summary Letter	2
73.	8/24/88	Letter to Stephen Holt	Brad Bradley	RI/FS Guidance Transmittal letter	1
74.	8/30/89	Letter to Stephen Holt	Ken Miller	Well Survey Transmittal Letter	1
75.	Various	QA Data Review File	Various	Same as Title	43
76.	April 1988	"Title 35: Environmental Protection Subtitle C: Water Pollution"	IEPA	Illinois Regulations	106
77.	3/27/84	HRS Scoring Package	U.S. EPA	Same as Title	22
78.	Various	Community Relations File	Various	Community Relations Plan, Fact Sheet, etc.	59
79.	Various	RCRA File	Various	Part A Permit, SLLR Closure Plan, etc.	82

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80.	5/28/85	Taracorp Access Agreement	W.K. Weddendorf	Same as Title	2
81.	10/24/89	Letter to Brad Bradley	Bonni Kaufman	Schedule for Response Under RI/FS order	2
82.	10/3/89	Letter to Stephen Holt	Brad Bradley	U.S. EPA and IEPA comments on draft Preliminary FS Report	13
83.	none	Pamphlet on Galena Industries	Galene, Ind	Lead Recycling System	3
84.	2/1/84	"Lead Exposure and the Health Effects on Children"	Minnesota Department of Health	Same as Title	99
85.	July 1988	"The Nature and extent of Lead Poisoning in Children in the United States"	ATSDR	Same as Title	561
86.	Various	Notice Letter/PRP File	Various	Notice Letters and PRP Information	123
87.	5/1/86	Trip Report	Brad Bradley	Summary of findings during a site visit	2+photos
88.	7/26/89	Door-to-Door private well survey	Dave Webb, Illinois Dept. of Health and Ken Miller	Survey forms of wells in area of site	64
89.	None	Packet	Various	Packet of Residential Area clean-up Issues at several Superfund Sites	11

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90. Various	Other RODs File	Various	Copies of other RODs and ROD abstracts involving soil Lead cleanup	138
91. 1/16/90	Letter to Valdas Adamkus, EPA	Steven Tasher, Wilkie Farr & Gallagher	Letter regarding Dispute Resolution	2
1/3/90	"Evaluation of Studies on Human Exposure to Soil Lead Residues"	O'Brien & Gere	Same as Title	9
93. 2/8/90	Public Meeting Handout	NL Industries	Handout presented at 2/8/90 Public Meeting in Granite City, IL	10
94. 10/26/89	Letter to Stephen Holt	Ken Miller	Articles on Lead Uptake	16
95. 11/10/89	Letter to U.S. EPA and IEPA	Stephen Holt	NL Industries Response to 10/3/89 draft Preliminary FS Comment Letter	9
96. 2/8/90	Public Meeting Transcript	Jo Elaine Foster & Associates	Same as Title	91
97. 1/3/89	Letter to Ken Miller	Dennis Kennedy Illinois Dept. Transportation	Floodway and Proposed Construction at NL Site	1
98. 2/14/90	Letter to Brad Bradley	Ken Miller	Alternative H ARARs Concerns	1

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99.	10/27/89	Article	"The U.S. EPA Weekly Report"	Lead-in- Soil Clean-up Plan comments	2
100.	3/12/90	Public Comment	Dames & Moore	Comment Regarding St. Louis Lead Recyclers	16
101.	August 1989	Draft Feasibility Study Report	O'Brien & Gere	Same as Title	142 + Tables & Figures
102.	1/10/90	FS Report Addendum	U.S. EPA	Same as Title	24
103.	1/10/90	Proposed Plan	U.S. EPA	Same as Title	26
104.	None	Cost Calculations	U.S. EPA	Cost Calculations for Alternatives	3
105.	May 1987	"Review and Recommendations on a Lead in Soil Guidance"	Hazardous Contaminants Branch	Report to the Minister of the Environment	56
106.	5/7-9/88	"Lead in Soil Issues and Guidelines"	H.W. Mielke	Proceedings from a Conference held in Chapel Hill, N.C.	10
107.	10/23/89	"Health Hazard and Risk Assessment from Exposure to Heavy Metals in ore in Skagway, Alaska"	J.P. Middaugh etal	Same as Title	20

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108.	2/1/90	"Acidity of Stomach Secretions in Humans, Rats and Pigs, and the Potential Importance of stomach pH in Bioavailability of Pb in Soils and Mine Wastes"	Rufus Chancey, USDA	Same as Title	11
109.	1987	"Toxic Effects of Lead in the Developing Nervous system: In Oculo Experimental Models"	B. J. Hoffer etal	Article from "Environmental Health Perspectives"	7
110.	None	Abstracts from "Medline/Lead"	Various	Listing of Lead studies	10
111.	Various	Excerpt from Integrated Risk Information system	None	Lead data	10
112.	January 1985	"Preventing Lead Poisoning in Young Children"	Centers for Disease Control	Same as Title	82
113.	May 1988	"Fact Sheet-Drinking Water and Lead"	U.S. EPA	Lead Data	4
114.	4/23/87	"Longitudinal Analyses of Prenatal and Postnatal Lead Exposure and Early Cognitive Development"	D. Bellinger etal	Article in "New England Journal of Medicine" Same as Title	7
115.	Various	Articles	Various	Three Articles Entitled "Sources of Lead in the Urban Environment," "The Potential for Heavy Metal Exposure from Urban Gardens and Soils," and "Lead Concentrations in Inner-City Soils as a Factor in the Child Lead Problem"	27
116.	1982	"Lead-Laden Freeway Parks Hazardous to Kids"	Louis Freedberg	Same as Title	4

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117.	7/11/84	"Condition and Type of Housing as an Indicator of Potential Environmental Lead Exposure and Pediatric Blood Lead Levels"	C.S. Clark	Article in "Environmental Research" Same as Title	3
118.	3/13/85	"Evolution of Efficient Methods to Sample Lead Sources, such as House Dust and Hand Dust, in the Homes of Children	S.S. Quettee etal	Same as Above	10
119.	3/1/88	"Lead and Osteoporosis: Mobilization of Lead from Bone in Postmenopausal Women"	E.K. Silbergeld	Same as Above	13
120.	December 1984	"Separating the Effects of Lead and Social Factors on IQ"	S.R. Schroeder	Same as Above	11
121.	1/11/90	"The Long-Term Effects of Exposure to Low Doses of Lead in Childhood"	Needleman etal	Article in "The New England Journal of Medicine" Same as Title	6
122.	8/25/88	"Port Pirie Cohort Study Enviromental Exposure in Lead and Children's Abilities at Age of Four Years"	McMichael etal	Same as above	8
123.	6/8/84	"The Relationship between Prenatal Exposure to Lead and a congenital Anomalies"	Needleman etal	Article in "JAMA" -Same as Title	4
124.	5/30/87	"Influence of Blood Lead on the Ability and Attainment of Children in Edinburgh"	Fulton etal	Articile in "The Lancet" -Same as Title	6
125.	None	"Neurobehavioral Effects of Lead"	R.L. Bornschein	Same as Title	15
126.	April 1985	"Home Refinishing, Lead Paint, and Infant Blood Lead Levels"	Rabinowitz etal	Article in "AJPH" - Same as Title	2

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127.	June 1986	"Exterior Surface Dust Lead, Interior House Dust Lead and Childhood Lead Exposure in an Urban Environment"	Bornschein etal	Same as Title 13
128.	1988	"Port Pirie Cohort Study: Childhood Blood Lead and Neuropsychological Development at age 2 years"	Wigg etal	Article in "Journal of Epidemiology and Community Health" -Same as Title 78
129.	3/12/90	Public Comment	Bradley O'Brien, Gardner Carter, & Douglas	Comment regarding NL Industries Public Comment 1
130.	None	Drawing	U.S. EPA	Sketch of possible Final contours for Expanded Taracorp pile 2
131.	None	"Assessing the Contribution from Lead in Mining Wastes to Blood Lead"	Steele etal	Same as Title 40
132.	None	"Low-Level Lead Exposure and Infant Development in the First Year"	Bellinger etal	Article in "Neurobehavioral Toxicology and Teratology" -Same as Title 11
133.	Various	Public Comments	Various	Public Comments received on NL Proposed Plan 269
134.	3/30/90	Conversation Record	Milt Clark U.S. EPA	Record of conversation with ATSDR regarding soil lead clean up levels 1

Draft Documents

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135.	September 1984	"Health Effects Assessment for Lead	Environmental Criteria and Assessment Office, U.S. EPA	Same as Title	45
136.	October 1989	"Technical Support Document on Lead"	Environmental Criteria and Assessment Office, U.S. EPA	Same as Title	78

Attached is a Compendium of CERCLA Response Selection Guidance Documents, which is part of this Index.

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COMPOUND OF CERCA RESPONSE SELECTION GUIDANCE DOCUMENTS

DOC NO	Vol Title	Date	Author/s	Status	Pages	Tier	Attachments	OSWER/EPA Number
0000	1 INDEX TO COMPOUND OF CERCA RESPONSE SELECTION GUIDANCE DOCUMENTS	05/01/89	DOPE - R.C. ENVIRONMENTAL MANAGEMENT, INC.	Final	8		1) DATA ELEMENT DEFINITIONS 2) ORGANIZATIONAL ABBREVIATIONS AND ACRONYMS IDENTIFIED IN INDEX	
0001	1 DEPAQD SITE INSPECTION TRANSITIONAL GUIDANCE FOR FY-88	10/01/87	OSBR	Final	74	2		OSWER #9345 1-02
0002	1 PRELIMINARY ASSESSMENT GUIDANCE FISCAL YEAR 1988	01/01/88	OSBR/A-SCD	Final	83	2		OSWER #9345 0-01
00	Normal Action							
1000	1 CERCA REMOVAL ACTIONS AT METHANE RELEASE SITES	01/23/86	LOCEST, H.L./OSBR	Final	2	2		OSWER #9360 0-8
1001	1 CERCA REMOVAL RESPONSE ACTIONS AT UNCONTROLLED HAZARDOUS WASTE SITES	01/01/81	RISER, H.L., ET AL /SCS ENGINEERS - ALBRECHT, D.W./MBRL	Final	164	1		
1002	1 EMERGENCY RESPONSE PROCEDURES FOR CONTROL OF HAZARDOUS SUBSTANCE RELEASES	01/01/83	MELVOLD, R.W./ROCKWELL INTERNATIONAL - MCCABE, L.T./MBRL	Final	23	1		EPA-600/D-84-023
1003	1 ENVIRONMENTAL REVIEW REQUIREMENTS FOR REMOVAL ACTIONS	04/13/87	OSBR/BD	Final	6	2		OSWER #9318 0-05
1004	1 GUIDANCE ON IMPLEMENTATION OF HF CONTINGENCY TO REMOVAL OPERATIONS PROVISION	04/06/87	OSBR	Final	6	2		OSWER #9360 0-13
1008	1 GUIDANCE ON HAZARDOUS REMOVAL ACTIONS INVOLVING NATIONALLY SIGNIFICANT OR PRECEDENT SETTING ISSUES	04/03/89	LOCEST, H.L./OSBR	Final	9	2	1) REQUEST FOR CLARIFICATION	OSWER #9360 0-19
1005	1 INFORMATION ON DRINKING WATER ACTION LEVELS	04/19/88	FIELDS, JR., T./OSBR/BD	Final	17	2	1) HMO: RELEASES FROM LAMINALLY APPLIED PESTICIDES 2) HMO DOP CONTAMINATION 3) GUIDANCE FOR ETHYLENE GLYCOLIDE IN DRINKING H2O	
1006	1 SUPERFUND REMOVAL PROCEDURES, REVISION #3	02/01/88	OSBR/OSBR	Final	365	1		OSWER #9360 0-038
1007	1 THE ROLE OF EXPEDITED RESPONSE ACTIONS UNDER SARA	04/21/87	LOCEST, H.L./OSBR	Final	3	2		OSWER #9360 0-15
4002	26 INTERIM FINAL GUIDANCE ON REMOVAL ACTION LEVELS AT CONTAMINATED DRINKING WATER SITES [Secondary Reference]	10/06/87	OSBR/OSBR	Final	9	2		OSWER #9360 1-01
6001	22 REMOVAL COST MANAGEMENT MANUAL [Secondary Reference]	04/01/88	OSBR/OSBR	Final	170	1		OSWER #9360 0-070

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COMPENDIUM OF CERCLA RESPONSE SELECTION GUIDANCE DOCUMENTS

DOC NO	VOL TITLE	Date	Authors	Status	Pages	Tier	Attachments	COSMR/EPA Number
..	RI/FS - General							
2000	2 CASE STUDIES 1-23: REMEDIAL RESPONSE AT HAZARDOUS WASTE SITES	03/01/84	ORD/DEET/MERL - COSMR/COSRR	Final	830	1		EPA 540/3-84/0038
2001	3 EPA GUIDE FOR MINIMIZING THE ADVERSE ENVIRONMENTAL EFFECTS OF CLEANUP OF UNCONTROLLED HAZARDOUS-WASTE SITES	06/01/85	ENVIRONMENTAL RESEARCH LABORATORY - COSMR/COSRR	Final	250	2		EPA/600/8-85/008
2002	3 GUIDANCE FOR CONDUCTING REMEDIAL INVESTIGATIONS AND FEASIBILITY STUDIES UNDER CERCLA	10/01/88	- COSMR/COSRR	Final	390	1		COSMR #9355.3-01
2003	3 JOINT CORPS/EPA GUIDANCE	06/24/83	- COSMR/PAAS	Final	42	2		COSMR #9395.2-02
2004	4 MODELING REMEDIAL ACTIONS AT UNCONTROLLED HAZARDOUS WASTE SITES (VOLUME I-IV)	04/01/85	RODMELL, S.H. ET AL./ROBERSON-NICHOLS AND CO - COSMR/COSRR - AMCH, D.C. AND RODMELL, JR. T.O. AMERL	Final	350	1		COSMR #9355.0-08
2005	4 POTENTIAL EFFECTS OF PLAINS AND WETLAND ASSESSMENTS FOR CERCLA ACTIONS	04/01/85	LEDEMAN, JR., W.N./COSRR - ILICRO, C./OMTE	Final	9	2		COSMR #9790.0-02
2006	4 REMEDIAL RESPONSE AT HAZARDOUS WASTE SITES: SUMMARY REPORT	03/01/84	- ORD/MERL	Final	95	1		EPA 540/3-84/003A
2007	4 REVISED PROCEDURES FOR IMPLEMENTING OFF-SITE RESPONSE ACTIONS	11/13/87	PORTER, J.W./COSMR	Final	20	2		COSMR #9834.11
2008	4 RI/FS IMPROVEMENTS	07/23/87	LO-CEST, H.L./COSRR	Final	11	2	1) RI/FS IMPROVEMENTS	COSMR #9355.0-20
2009	4 RI/FS IMPROVEMENTS FOLLOW-UP	04/25/88	LO-CEST, H.L./COSRR	Final	16	2	1) RI/FS IMPROVEMENTS FOLLOW-UP 2) REMEDIAL INFORMATION TRANSFER ACTIVITIES	COSMR #9355.3-05
2010	4 SUPERFUND FEDERAL-LEAD REMEDIAL PROJECT MANAGEMENT HANDBOOK	12/01/86	- COSRR	Drill	179	1		COSMR #9355.1-1
2011	5 SUPERFUND REMEDIAL DESIGN AND REMEDIAL ACTION GUIDANCE	06/01/86	- COSRR	Final	100	1		COSMR #9355.0-4A
2012	5 SUPERFUND STATE-LEAD REMEDIAL PROJECT MANAGEMENT HANDBOOK	12/01/86	- COSRR	Final	120	1		COSMR #9355.2-1
..	RI/FS - RI Data Quality/site & Waste Assessment							
2100	5 A COMPENDIUM OF SUPERFUND FIELD OPERATIONS METHODS	12/01/87	- COSRR - OPE	Final	550	1		COSMR #9355.0-14
2101	6 DATA QUALITY OBJECTIVES FOR REMEDIAL RESPONSE ACTIVITIES: DEVELOPMENT PROCESS	03/01/87	- CON FEDERAL PROGRAMS CORP. - COSRR/OMTE	Final	130	1		COSMR #9355.0-70

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2103	6 DESIGN AND IMPLEMENTATION OF HAZARDOUS WASTE REACTIVITY TESTING PROTOCOL	07/01/84	- KOBACH, C.D., ET AL./ACORD CORP. - BARLEY, N./MDL	Final	150	1		EPA-600/7-84-037
2104	6 FIELD SCREENING FOR ORGANIC CONTAMINANTS IN SAMPLES FROM HAZARDOUS WASTE SITES	04/03/86	- ROYMAN, H.K., ET AL./EPA CORP. - CARTER, A./MICHIGAN DEPT. OF NATURAL RESOURCES	Final	11	2	1) MEMO: FIELD SCREENING FOR ORGANIC CONTAMINANTS	
2105	6 FIELD SCREENING METHODS CATALOG: USER'S GUIDE	09/01/88	- EPA	Final	90	1		EPA/540/7-88/005
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2107	7 FIELD STANDARD OPERATING PROCEDURES MANUAL #6-WORK ZONES	04/01/85	- CDM/ARSD	Final	19	2		CDMR #9285 2-04
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2111	7 GEOTECHNICAL TECHNIQUES FOR SINKING FLAIED WASTES AND WASTE ALLOCATION	06/01/84	- VANCE, J.J./EPA - ROSSON, R.C., ET AL./TOWNS, INC.	Final	226	1		EPA-600/7-84/064
2112	8 GUIDELINES AND SPECIFICATIONS FOR PREPARING QUALITY ASSURANCE PROGRAM DOCUMENTATION	06/01/87	- VANCE, J.J./EPA - QUALITY ASSURANCE MANAGEMENT STAFF	Final	31	2	1) MEMO: GUIDANCE ON PREPARING QA/AS DATED 6/10/87	
2113	8 LABORATORY DATA VALIDATION FUNCTIONAL GUIDELINES FOR EVALUATING INFECHS ANALYSES	07/01/88	- EPA DATA REVIEW WORK GROUP - BLETNER, R./EPA AND CD/SAMPLE MGMT. OFFICE	Draft	20	2		
2114	8 LABORATORY DATA VALIDATION FUNCTIONAL GUIDELINES FOR EVALUATING ORGANICS ANALYSES	07/01/88	- BLETNER, R./EPA AND CD/SAMPLE MGMT. OFFICE - EPA DATA REVIEW WORKGROUP - HSD	Draft	45	2		

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2116	8 SEDIMENT SAMPLING QUALITY ASSURANCE USER'S GUIDE	07/01/85	SCALF, M.R./ORD/ERL BARTH, D.S. & STARKS, T.S./UNIV. OF NEV. LAS VEGAS	Final	120	1		EPA/600/4-85/048
2117	8 SOIL SAMPLING QUALITY ASSURANCE USER'S GUIDE	05/01/84	BROWN, K.W./EARD BARTH, D.S. & WADSON, B.J./U. OF NEVADA, LAS VEGAS	Final	104	1		EPA 600/4-84/043
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2119	11 USER'S GUIDE TO THE CONTRACT LABORATORY PROGRAM	12/01/88	OSWER/CLP SAMPLE MANAGEMENT OFFICE	Final	220	2		OSWER #9740 0-1
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2200	12 CMRS FOR UNCONTROLLED HAZARDOUS WASTE SITES	09/01/85	MCANDY, C.G. ET AL./U.S. COE/WES KUTY-COED, J.M./MERL	Final	475	2		EPA/340/2-85/002
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2202	13 EVALUATING COVER SYSTEMS FOR SOLID AND HAZARDOUS WASTE	09/01/82	LUTTON, R.J./U.S.A. COE/WES LAWRENTH, R.E./MERL	Final	58	2		OSWER #9476 00-1
2203	13 GUIDANCE MANUAL FOR MINIMIZING POLLUTION FROM WASTE DISPOSAL SITES	08/01/78	TOLMAN, A.L. ET AL./A.W. MARTIN ASSOCIATES, INC. SANNING, D.E./MERL	Final	83	1		EPA-600/2-78-142
2204	13 LAND DISPOSAL RESTRICTIONS	08/11/87	LONGEST, M.L./OSWER LUCERO, C./OSPE	Final	23	2	1) SUMMARY OF MAJOR LDR PROVISIONS AND CALIFORNIA LIST PROHIBITIONS 2) OTHER ATTACHMENTS CITED ARE AVAILABLE IN	

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2206	15 LINING OF WASTE IMPOUNDMENT AND DISPOSAL FACILITIES	03/01/83	- LANDRETH, R./MERL	Final	480	2		OSWER #9480.00-4
2207	15 PROCEDURES FOR MODELING FLOW THROUGH CLAY LINERS TO DETERMINE REQUIRED LINER THICKNESS	01/01/84	- OSWER	Draft	145	2		OSWER #9480.00-9D
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2209	15 SETTLEMENT AND COVER SINKING OF HAZARDOUS WASTE LANDFILLS: PROJECT SUMMARY	05/01/85	- MURPHY, W.L. - GILBERT, P.A.	Final	4	2		EPA-600/52-85-035
2210	15 SUPPLEMENTARY GUIDANCE ON DETERMINING LINER/LEACHATE COLLECTION SYSTEM COMPATIBILITY	08/07/86	- NEEDLE, B.R./PERMITS AND STATE PROGRAMS DIV	Final	60	2	1) ANALYSIS AND FINGERPRINTING OF UNEXPOSED & EXPOSED POLYMERIC MEMBRANE LINERS MATRECON, INC. 2) SEC. 3019 EXPOSURE INFO AND HEALTH ASSESSMENTS	OSWER #9480.00-13
2211	15 TECHNICAL GUIDANCE DOCUMENT: CONSTRUCTION QUALITY ASSURANCE FOR HAZARDOUS WASTE LAND DISPOSAL FACILITIES	10/01/86	- TERRAMANN, J.C./MTRC/LAND POLLUTION CONTROL DIV. - OSWER	Final	88	2		OSWER #9472.003
2212	15 IMPAIRMENT OF REACTIVE WASTES AT HAZARDOUS WASTE LANDFILLS: PROJECT SUMMARY	01/01/84	- SEITZER, D. ET AL /ARTHUR D. LITTLE, INC. - LANDRETH, R./MERL	Final	4	2		EPA/600/52-83/118
3000	25 APPLICABILITY OF THE RCRA MINIMUM TECHNICAL REQUIREMENTS RESPECTING LINERS AND LEACHATE COLLECTION SYSTEMS [Secondary Reference]	04/01/85	- SKINNER, J./OSM	Final	3	2		OSWER #9480.01(85)
2200	16 A COMPENDIUM OF TECHNOLOGIES USED IN THE TREATMENT OF HAZARDOUS WASTES	09/01/87	- ORD/CERI	Final	49	2		EPA/625/8-87/014

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2202	17 ENGINEERING HANDBOOK FOR HAZARDOUS WASTE INCINERATION	09/01/81	BOYNER, T.A., ET. AL./MOSMANT RESEARCH CORP.	Final	445	2		COMER #9488-00-5
2203	17 EPA GUIDE FOR IDENTIFYING CLEANUP ALTERNATIVES AT HAZARDOUS WASTE SITES AND SPILLS: BIOLOGICAL TREATMENT	-	COMER, D.A./OCEI - PACIFIC NORTHWEST LABORATORY - RAVENHILL, L.C./ORVALLIS BIOMEDICAL RESEARCH LAB	Final	120	2		EPA-600/3-83-063
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2206	17 GUIDANCE DOCUMENT FOR CLEANUP OF SURFACE TANK AND DRUM SITES	03/28/83	COMER/COM-CLYDE/ROY F. WESTON/C.C. JOHNSON - BARNHILL, E. AND BILKLEY, B./COMR	Final	135	1		COMER #9380-0-03
2207	18 HANDBOOK FOR EVALUATING REMEDIAL ACTION TECHNOLOGY PLANS	06/01/83	BARNHILL, J. AND HASS, J./ARNDT D. LITTLE INC.	Final	439	1		EPA-600/2-83-076
2208	18 HANDBOOK FOR STABILIZATION/SOLIDIFICATION OF HAZARDOUS WASTE	06/01/86	PARSONS, H.R./MRL - CLINE, JR., M.J., ET. AL./U.S. COMER/MS	Final	125	1		EPA/540/2-86-001
2209	19 HANDBOOK REMEDIAL ACTION AT WASTE DISPOSAL SITES (REVISED)	10/01/83	COMER/COM - COMER/COMR	Final	560	1		EPA/635/6-83/006
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2211	20 ACUTE TREATMENT TECHNOLOGIES FOR SUPERFUND WASTES	09/01/86	CAMP, DRESSER, AND KEE INC. - CALER, L.D./ARSD	Final	130	1		EPA/540/2-86-003F
2212	21 PRACTICAL GUIDE-TRIAL GUIDE FOR HAZARDOUS WASTE INCINERATORS	04/01/86	COMER, P., ET. AL./MIDWEST RESEARCH INSTITUTE - COMER, D.A./MRL	Final	63	2		EPA/600/2-86/030
2213	21 PRACTICAL GUIDE-TRIAL PLANS FOR HAZARDOUS WASTE INCINERATORS. PROJECT SUMMARY	07/01/86	COMER, P., ET. AL./MIDWEST RESEARCH INSTITUTE - COMER, D.A./MRL	Final	2	1		EPA/600/52-86/050

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2315	21 REVIEW OF IN-PLACE TREATMENT TECHNIQUES FOR CONTAMINATED SURFACE SOILS-VOL. 2: BACKGROUND INFORMATION FOR IN-SITU TREATMENT	11/01/84	SIMS, R.C., ET AL./IRB ASSOCIATES - BARKLEY, M./MBRL	Final	350	1		EPA-540/2-84-003D
2316	21 REVIEW OF IN-PLACE TREATMENT TECHNIQUES FOR CONTAMINATED SURFACE SOILS-VOL. 1: TECHNICAL EVALUATION	09/19/84	OSWER/OSM - ORO/MBRL	Final	165	1		EPA/540/2-84-003B
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2318	22 SYSTEMS TO ACCELERATE IN SITU STABILIZATION OF WASTE DEPOSITS	09/01/86	ANDERSON, M., ET AL./ENVIROSCORP CO. - ORLE, W./MBRL	Final	285	1		EPA 540/2-86/002
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2400	23 CRITERIA FOR IDENTIFYING AREAS OF VULNERABLE IMPROVEDITY UNDER RORA: STATUTORY INTERPRETIVE GUIDANCE	07/01/86	OSM/OSM	Final	950	2		OSWER #9472-00-2A
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2402	24 GROUND-WATER MONITORING AT CLEAN-UP SITES: SURFACE IMPLICATIONS AND WASTE PILE UNITS	03/31/88	MBRL, J.W./OSM	Final	3	2		OSWER #9476-00-14
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2404	24 GUIDELINES FOR GROUND-WATER CLASSIFICATION UNDER THE EPA GROUND-WATER PROTECTION STRATEGY	12/01/86	OFFICE OF GROUND-WATER PROTECTION	Dist	600	2		
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2407	25 RCRA GROUND-WATER MONITORING TECHNICAL ENFORCEMENT GUIDANCE DOCUMENT (TECD)	09/01/86	EPA	Final	270	2		OSWER #9950.1
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2405	24 OPERATION AND MAINTENANCE INSPECTION GUIDE (RCRA GROUND-WATER MONITORING SYSTEMS) [Secondary Reference]	03/30/88	OSWER/OMPE/RCRA ENFORCEMENT DIVISION	Final	50	2	1) TRANSMITTAL MEMO RE SAME SUBJECT	OSWER #9950-3
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5006	27 GUIDELINES FOR MUTAGENICITY RISK ASSESSMENT (FEDERAL REGISTER, SEPTEMBER, 24, P. 34006)	09/24/86	EPA	Final	8	2		
5007	27 GUIDELINES FOR THE HEALTH RISK ASSESSMENT OF CHEMICAL MIXTURES (FEDERAL REGISTER, SEPTEMBER 24, 1986, P. 34014)	09/24/86	EPA	Final	13	2		
5008	28+ HEALTH EFFECTS ASSESSMENT DOCUMENTS (58 CHEMICAL PROFILES) VOL 28: ACETO-E, ARSENIC, ASBESTOS, BARIUM, BENZO(A)PYRENE, CACILIA, CARBON TETRAOCHLORIDE, CHLOROBENZENE, CHLOROMETHYL CHLORIDE, COAL TARS, COPPER, CRESOLS, CYANIDE, DDT, 1,1-DIOCHLOROMETHANE, 1,2-DIOCHLOROMETHANE, VOL 29: 1,1-DIOCHLOROMETHANE, 1,2-DIOCHLOROMETHANE, CIS-1,2-DIOCHLOROMETHANE, ETHYLBENZENE, CYCLO ETHERS, HEXACHLOROBENZENE, HEXACHLOROCYCLOPENTADIENE, HEXACHLOROCYCLOHEPTADIENE, HEXACHLOROCYCLOOCTADIENE, HEXACHLOROCYCLONONADIENE, IRON (AND COMPOUNDS), LEAD, LINDANE, MANGANESE (AND COMPOUNDS), MERCURY, METHYL ETHYL KETO-E, METHYLIDE CHLORIDE, NITROMETHANE, NICKEL, PENTACHLOROBENZOL, PHENOL, PHENANTHRENE, VOL 30: POLYCHLORINATED BIPHENYLS (PCBS), POLYCYCLIC AROMATIC HYDROCARBONS (PAHS), PRIBNE, SELENIUM (AND COMPOUNDS), SODIUM CYANIDE, SULFURIC ACID, 2,3,7,8-TETRAOCHLORODIBENZO-P-DIOXIN, 1,1,2,2-TETRAOCHLOROMETHANE, TETRAOCHLOROMETHANE, TOLUENE, 1,1,2-TRIOCHLOROMETHANE, 1,1,1-TRIOCHLOROMETHANE, TRIOCHLOROMETHANE, 2,4,5-TRIOCHLOROBENZOL, 2,4,6-TRIOCHLOROBENZOL, TRIVALENT CHROMIUM, VINYL CHLORIDE, XYLENE, ZINC (AND COMPOUNDS)	09/01/84	OSWER/EPA/ECAC	Final	1750	2		
5009	31 INTEGRATED RISK INFORMATION SYSTEM (IRIS) [A COMPUTER-BASED HEALTH RISK INFORMATION SYSTEM AVAILABLE THROUGH E-MAIL--FREETURE ON ACCESS IS INCLUDED]		OEA	Final	-	2		

EPA/340/1-86/001-038

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COMPENDIUM OF CERCLA RESPONSE SELECTION GUIDANCE DOCUMENTS

Doc NO	Vol Title	Date	Authors	Status	Pages	Tier	Attachments	OSWER/EPA Number
5010	31 INTERIM POLICY FOR ASSESSING RISKS OF "DICKING" OTHER THAN 2.3.7.8-1000	01/07/87	THOMAS, L.M./EPA	Final	50	2	1) INTERIM PROCEDURES FOR ESTIMATING RISKS ASSOCIATED WITH EXPOSURES TO MIXTURES: 10/86	
5011	31 PUBLIC HEALTH RISK EVALUATION DATABASE (PHRED) (USER'S MANUAL AND TWO DISKETTES CONTAINING THE DATABASE) PLUS SYSTEM ARE INCLUDED)	09/16/88	OSWER/TOXICS INTEGRATION BRANCH	Final	-	2		
5012	31 ROLE OF ACUTE TOXICITY BIOASSAYS IN THE REMEDIAL ACTION PROCESS AT HAZARDOUS WASTE SITES	08/01/87	ATHEY, L.A., ET AL PACIFIC NORTHWEST LABORATORY - MILLER, W.E./CORVALLIS ENVIRONMENTAL RESEARCH LAB	Final	106	2		FWA/600/8-87/044
5013	31 SUPERFUND EXPOSURE ASSESSMENT MANUAL	04/01/88	OSWER	Final	160	1		OSWER #9285.5-1
5014	31 SUPERFUND PUBLIC HEALTH EVALUATION MANUAL	10/01/86	OSWER	Final	500	1		OSWER #9285.4-1
5015	31 TOXICOLOGY HANDBOOK	08/01/85	LIFE SYSTEMS, INC. - TYBURSKI, T.E./OSPE	Draft	126	2		OSWER #9850.2
8000	32 ENVIRONMENTAL ASSESSMENT GUIDANCE (Secondary Reference)	11/22/85	MORTER, J.W./OSWER	Final	11	2		OSWER #9850.0-1
6000	32 REMEDIAL ACTION COSTING PROCEDURES MANUAL	10/01/87	IRB ASSOCIATES/ODM HILL - ODO/MOBL	Final	56	1		
6001	32 REMOVAL COST MANAGEMENT MANUAL	04/01/88	OSWER/OSWR	Final	170	1		OSWER #9360.0-02B
1003	1 ENVIRONMENTAL REVIEW REQUIREMENTS FOR REMOVAL ACTIONS (Secondary Reference)	04/13/87	OSWER/ERO	Final	6	2		OSWER #9318.0-05
7000	32 COMMUNITY RELATIONS IN SUPERFUND: A HANDBOOK (INTERIM VERSION)	06/01/88	OSWR	Final	188	2	1) OMP, 6 OF THE CDA, REL. HANDBOOK 11/03/88	OSWER #9230.0-03B

.. Community Relations

.. Cost Analysis

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.. Enforcement

8000 32	BOARDERMENT ASSESSMENT GUIDANCE	11/22/85	PORTER, J.M./OSWER	Final	11	2		OSWER #9830.0-1
8001 32	INTERIM GUIDANCE ON POTENTIALLY RESPONSIBLE PARTY PARTICIPATION IN REMEDIAL INVESTIGATIONS AND FEASIBILITY STUDIES	05/16/88	PORTER, J.M./OSWER	Final	37	2		OSWER #9835.12

.. Selection of Remedy/Decision Documents

9000 32	INTERIM GUIDANCE ON SUPERFUND SELECTION OF REMEDY	12/24/86	PORTER, J.M./OSWER	Final	10	2		OSWER #9355.0-19
9001 32	REMEDIATION DECISIONS MADE ON REMEDY SELECTION	06/24/85	KILPATRICK, M./COMPLIANCE BRANCH, ONCE FINAL	Final	3	2		

IEPA Record of Decision Declaration For the NL Industries/Taracorp
NPL Site in Granite City, Illinois

The selected remedy is protective of human health and the environment, attains Federal and State requirements that are applicable or relevant and appropriate for this remedial action, and is cost-effective. This remedy satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

Because this remedy will result in hazardous substances remaining on-site, U.S. EPA is expected to conduct a review no less than five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human and health and environment.

Based on the information described above, the IEPA adopts and concurs with the decision the U.S. EPA has made in selecting this remedy.

3/29/80
Date

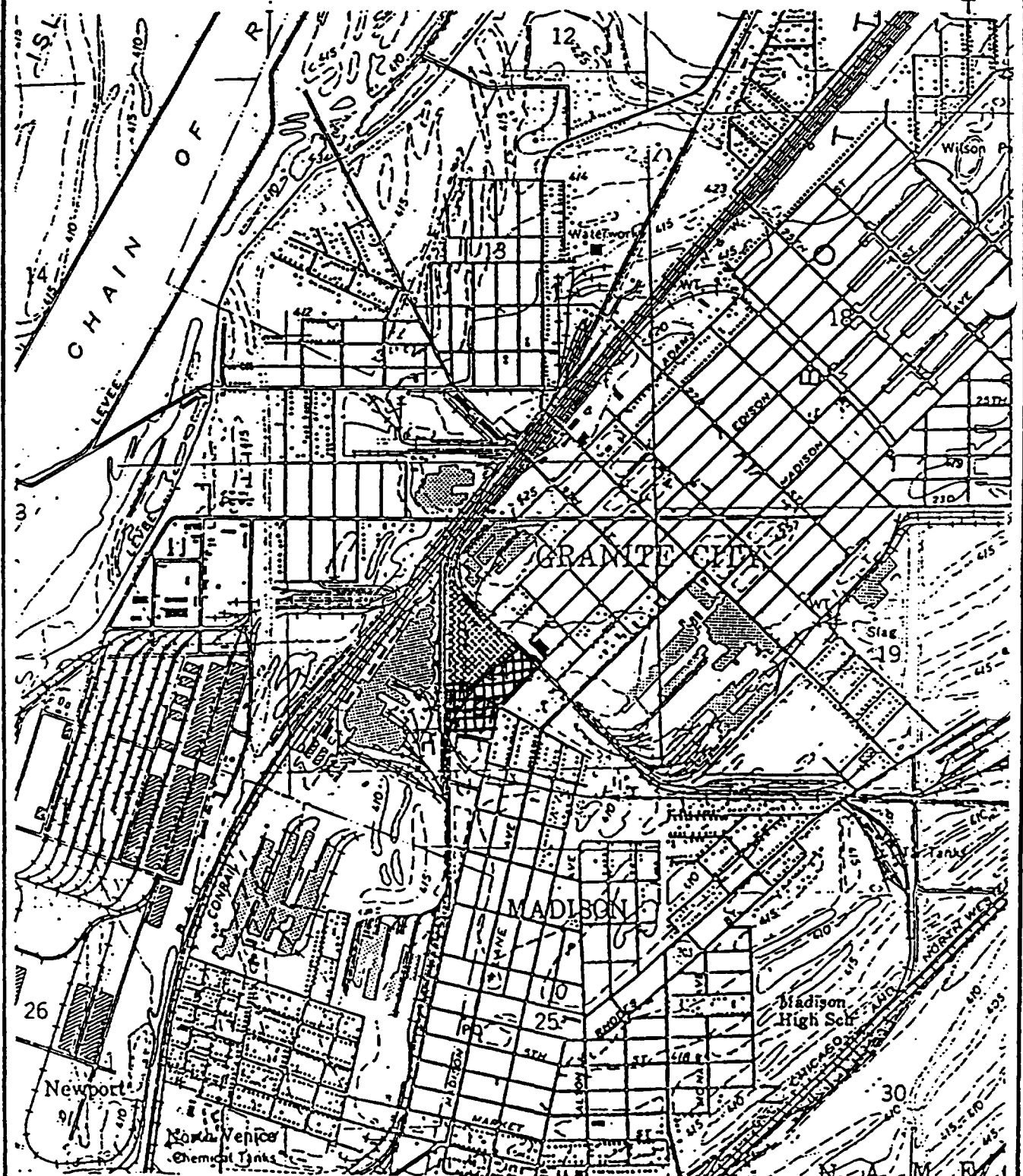
Bernard P. Killian
Bernard P. Killian
Director

AREA 1



NL INDUSTRIES
GRANITE CITY SITE
GRANITE CITY, ILLINOIS

LOCATION MAP



 - PROJECT SITE



SCALE



NOTE: MAP ADAPTED FROM U.S.G.S.

**RECORD OF DECISION SUMMARY
NL INDUSTRIES/TARACORP SITE
GRANITE CITY, ILLINOIS**

I. SITE BACKGROUND

The NL Industries/Taracorp Site ("the NL Site" or "the Site") is located within a heavily industrialized section of Granite City, Illinois, a community of approximately 40,000 people located across the Mississippi River from St. Louis, Missouri. Although the site is located within the Mississippi River Valley, it is not within the 100-year flood plain of any surface water. The location of the site is shown on Figure 1. Figure 2 presents the site plan, and Figure 3 shows the 100-year flood plain in the vicinity of the site.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

The NL Site is the location of a former secondary lead smelting facility. Metal refining, fabricating, and associated activities have been conducted at the site since before the turn of the century. Prior to 1903, the facilities at the site included a shot tower, machine shop, factory for the manufacture of blackbird targets, sealing wax, manufacture of mixed metals, refining of drosses, and the rolling of sheet lead. From 1903 to 1983 secondary lead smelting occurred on-site. Secondary smelting facilities included a blast furnace, a rotary furnace, several lead melting kettles, a battery breaking operation, a natural gas-fired boiler, several baghouses, cyclones and an afterburner. Secondary lead smelting operations were discontinued during 1983 and equipment dismantled.

In July of 1981, St. Louis Lead Recyclers, Inc. (SLIR) began using equipment on adjacent property owned by Trust 454 to separate components of the Taracorp waste pile. The objective was to recycle lead bearing materials to the furnaces at Taracorp and send hard rubber and plastic off-site for recycling. SLIR continued operations until March 1983 when it shut down its equipment. Residuals from the operation remain on Trust 454 property as does some equipment.

A State Implementation Plan for Granite City was published in September 1983 by the Illinois Environmental Protection Agency (IEPA). The IEPA's Report indicated that the lead nonattainment problem for air emissions in Granite City was in large part attributable to emissions associated with the operation of the secondary lead smelter operated by Taracorp and lead reclamation activities conducted by SLIR. The IEPA procured Administrative Orders by Consent with Taracorp, St. Louis Lead Recyclers Inc., Stackorp, Inc., Tri-City Truck Plaza, Inc., and Trust 454 during March 1984. The Orders required the implementation of remedial activities relative to the air quality.

NL Industries (NL), as former owner of the site, voluntarily entered into an Agreement and Administrative Order by Consent with the U.S. Environmental Protection Agency (U.S. EPA) and IEPA in May 1985 to implement a Remedial Investigation and Feasibility Study (RI/FS)

for the site and other potentially affected areas. Taracorp was not a party to the agreement due to the fact that it filed for bankruptcy. The U.S. EPA determined that the site was a CERCLA facility and it was placed on the National Priorities List on June 10, 1986.

III. COMMUNITY RELATIONS HISTORY

U.S. EPA published the Proposed Plan in accordance with CERCLA Section 117. This document and the draft Feasibility Study (FS) Report and associated FS Addendum were made available to the public on January 10, 1990, at the beginning of a 45 day public comment period. The comment period was extended an additional 15 days to March 12, 1990, due to extensive community interest and response to the proposed remedy for the site. Availability sessions were held on January 23-25, 1990, and March 5, 1990, and a public meeting was held on February 8, 1990. Approximately 240 people attended the public meeting and expressed their concerns. Comments received during the public comment period and the responses to those comments are contained in the Responsiveness Summary (Appendix A).

IV. SCOPE AND ROLE OF THE RESPONSE ACTION

NL Industries, a Potentially Responsible Party (PRP) and former site owner/operator, under the direction of U.S. EPA and IEPA, initiated a RI/FS at this site. Activities performed under the May 1985, RI/FS Administrative Order by Consent included determining the nature and extent of contamination at the site and evaluating the feasibility of various remedial alternatives to clean up the site.

This Record of Decision (ROD) addresses contaminated soil and waste materials on the site, in adjacent residential areas, and in nearby alleys, driveways and residential areas. These areas were determined to be a principal threat at the site due to the potential risk from direct contact, ingestion, and inhalation of contaminated soils, dust, and waste materials. The surface water and air exposure pathways did not present an unacceptable risk to human health and the environment, and groundwater was not contaminated immediately downgradient (200-300 feet) from the site; however, the deeper portion of the upper aquifer was not sampled. This is the first and only planned response action at the site.

V. SITE CHARACTERISTICS

The RI was conducted by NL under the direction of U.S. EPA and IEPA to determine the nature and extent of contamination at the NL Site. Field activities were conducted from December 1986 through November 1987. Field aspects of the investigation included excavating test pits in the Taracorp pile, constructing monitoring wells, collecting representative samples of waste materials, soils, surface water, sediment, groundwater, and air, and conducting aquifer tests.

The NL Site is located in the Southwestern portion of Madison County, Illinois within the Mississippi River Valley. The site is approximately eight to ten miles south of the confluence of the Mississippi and Missouri Rivers. The site is underlain by recent alluvium and glaciofluvial and glaciolacustrine deposits. Bedrock beneath the alluvium is Carboniferous age rocks consisting of limestone, sandstone and shale. The alluvial and glacial deposits which fill the valley range in thickness from less than one foot adjacent to the bluff boundary and the Chain of Rocks reach of the Mississippi River to greater than 170 feet near the City of Wood River. The fill thickness across the entire area averages approximately 120 feet. The estimated thickness of the valley deposits beneath the site is approximately 100 to 120 feet. Investigations conducted by the Illinois State Water Survey have revealed the valley deposits become progressively coarser with depth. Generally, groundwater in the Granite City area occurs within the unconsolidated valley deposits under unconfined and leaky confined conditions. Recharge of groundwater within the area is from precipitation and induced infiltration of surface water from the Mississippi River and smaller surface water bodies in the area.

A search of available hydrogeologic data, door-to-door surveys in areas immediately downgradient of the site, and hydrogeologic field investigations conducted during the RI indicated the following:

- residents of Granite City drink water provided by the city which is obtained from the Mississippi River.
- only one well in the downgradient vicinity of the site was in use; it was used for lawn watering.
- the water table was encountered at an average depth of 24 feet below ground surface.
- the horizontal hydraulic conductivity of the site ranged from 5.3×10^{-4} cm/sec to 2.0×10^{-2} cm/sec within the shallow portion (approximately 20 feet deep) of the aquifer and 4.3×10^{-4} cm/sec to 6.1×10^{-2} cm/sec in the "deeper" zone (approximately 35 feet deep).
- groundwater flow is in a south-southwesterly direction across the site, toward the Mississippi River.
- the linear groundwater flow velocity has been calculated as ranging from 3×10^{-3} ft/day to 0.5 ft/day in the shallow portion of the aquifer and 2×10^{-3} ft/day to 0.5 ft/day in the "deeper" zone.
- a downward vertical gradient was identified in some of the well nests at the site.

Results of the RI, which was finalized on February 1, 1989, with Addendum dated January 10, 1989, are summarized below:

Areas of contamination (Refer to Figure 4):

Taracorp Pile

Located on the site is a pile composed primarily of blast furnace slag and battery case material. The volume of the pile is approximately 85,000 cubic yards. In addition, smaller piles immediately adjacent to the Taracorp pile, which were associated with the adjacent SLIR recycling operation, comprise approximately 2450 cubic yards. Tests conducted on the materials in the Taracorp pile and small SLIR piles demonstrate lead concentrations in the range of 1-28%. EP toxicity test results demonstrate that the waste pile materials are a characteristic hazardous waste under 40 CFR Part 261. In addition, on the surface of the pile are 25-35 drums and containers holding solid wastes from the smelting operations which normally would be recycled. These containers remained after the smelting operations ceased in 1983.

Area 1 Battery Case Material and Soils

Area 1 consists of property owned by Trust 454 and Tri-City Trucking. These properties about the NL Site and were the subject of previous regulatory action. The limits of Area 1 are shown on Figure 4.

Trust 454 property contains a pile of battery case materials (the St. Louis Lead Recyclers or SLIR pile) as well as unpaved areas. The SLIR pile contains approximately 4000 cubic yards in two general areas. The lead concentration range in this pile was 10-30%. EP toxicity analyses of the pile materials indicate that this material has characteristics similar to those of the Taracorp pile and should be managed as hazardous waste. Analyses of the unpaved area indicate a lead concentration at the surface of 9250 mg/kg.

Tri-City Trucking property includes a large unpaved area which is used to park and service trucks. Analyses of soils from areas around this property suggest that the soils contain lead concentrations in the range of 12,000 to 75,000 mg/kg.

Surface Soils

Surface soil samples were collected from 50 locations not including Taracorp or Trust 454 properties. Generally samples were collected at depths of 0-3 and 3-6 inches below grade. With the exception of one anomalous value approximately 3200 feet from the site boundary, the results indicate that the lead concentration in surface soils (0-3 inches) within 1/4 mile of the site boundary were higher (514-4150 mg/kg) than those further from the site (139-983 mg/kg). Samples collected from the surface (0-3 inches) generally contained more lead (average 1160 mg/kg) than the deeper (3-6 inch) samples which averaged 560 mg/kg. Refer to Figure 5 for the estimated areas of lead contamination above 500 ppm.

Eagle Park Acres

Eagle Park Acres includes some vacant land to which battery case material was previously hauled. The battery case material was used to fill a ditch on the property and a portion has been uncovered during subsequent excavation. The approximate volume of material and surrounding soil at Eagle Park Acres is 2700 cubic yards. Testing of the soil in this area indicated surface lead concentrations ranging from 63 mg/kg to 3280 mg/kg. Refer to Figure 6 for the estimated areas of contamination in Eagle Park Acres.

Venice Township Alleys

According to residents in the area, Venice Township hauled hard rubber case material to unpaved alleys in Venice Township. Tests conducted on these alleys resulted in a wide range of lead concentrations. Surface lead concentrations ranged from 200 mg/kg to 126,000 mg/kg. The estimated volume of battery case material and associated soil in these alleys is 670 cubic yards. Refer to Figure 7 for estimated areas of contamination in Venice.

Groundwater

Background water quality at the site is characterized by elevated concentrations of dissolved solids, sulfates, and manganese. Collectively, a shallow and adjacent deep well located on the site demonstrated elevated concentrations (as compared to background) of sulfates, dissolved solids, arsenic, cadmium, manganese, nickel, and zinc. However, data from the shallow and deep wells located hydraulically downgradient demonstrated water quality similar to that in the background monitoring well. The possibility of a strong downward hydraulic gradient was identified during the RI.

Surface Water and Air

No surface water is present at the site; runoff away from the area of the Taracorp pile is limited to the property of Tri-City Trucking, Trust 454, and Taracorp.

Results of air monitoring for lead conducted by IEPA have indicated that emissions from the site are well within the National Ambient Air Quality Standard for lead since Taracorp ceased smelting operations in 1983.

Post RI information and Inspections

An inspection conducted with residents of Eagle Park Acres indicated that battery case material was used for fill much more extensively than indicated in the draft FS Report. Many former driveways and parking lots throughout the area contain battery case material at the surface; others have been covered with an undetermined depth of fill material. The estimated volume of contaminated material in the draft FS Report is low.

During the public comment period, many residents indicated areas in Granite City which contained battery case material as fill. These areas are currently being investigated. It should be noted that Figures 5, 6 and 7 were generated based on information available at the time of the Feasibility Study, and therefore, represent only estimated areas of contamination/remediation.

VI. SUMMARY OF SITE RISKS

The Risk Assessment included in the RI Report identified two complete exposure pathways that exist at the site: direct contact with contaminated waste materials and soils, and inhalation of contaminated airborne dust. Lead was identified as the primary contaminant of concern at the site, and all remedial activities included in alternatives in the FS are based on lead contamination levels.

Based on the above information, it was determined that remedial alternatives considered should address the Taracorp pile, Area 1 battery case materials and soils, nearby residential surface soils, battery case materials at Eagle Park Acres and in Venice Township Alleys, and the potential data gap presented by the possible strong downward hydraulic gradient near the site.

U.S. EPA and IEPA did not agree with the portions of the Risk Assessment conducted by NL Industries which selected soil cleanup levels for lead. This dispute led to the drafting of an FS Addendum by U.S. EPA and IEPA which added an eighth alternative, Alternative H, to the list of alternatives to be evaluated for the site. Among other things, Alternative H utilized a 500 ppm soil lead cleanup level for residential areas around the site. Documentation for the selection of this cleanup level is included in Appendix B.

VII. DESCRIPTION OF ALTERNATIVES

The alternatives that underwent detailed analysis are briefly described below.

Alternative A - No Action

Monitoring:	Air Quality Monitoring; Ground Water Monitoring, Additional Deep Wells.
Institutional Controls:	Site Access Restrictions; Land Use Restrictions; Deed Restrictions; Sale Restrictions.

Estimated Total Remedial Costs: \$475,110 Present Worth
Estimated Months to Implement: 6-12

The no action alternative (A) includes a group of activities that can be used to monitor contaminant transport. The sources considered potentially viable include air, surface soils, and groundwater. It includes institutional controls on the Taracorp property and other properties where residual concentrations do not meet Remedial Objectives. In addition, a minimum of one upgradient and three downgradient deep wells would be installed to monitor water quality in the lower portion of the aquifer; well nests or clusters would be employed wherever possible.

Alternative B

Taracorp Pile:	Multimedia Cap, Institutional Controls.
Taracorp Drums:	Off-Site Recovery at Secondary Lead Smelter.
SLIR Piles:	Excavate and Consolidate with Taracorp Pile.
Venice Alleys:	Asphalt or Sod Cover Based on Usage.
Eagle Park Acres:	Vegetated Clay Cap, Institutional Controls.
Area 1 Unpaved Surfaces:	Asphalt or Sod Cover Based on Usage.
Area 2 Unpaved Surfaces:	Asphalt or Sod Cover Based on Usage.
Area 3 Unpaved Surfaces:	Asphalt or Sod Cover Based on Usage.
Monitoring:	Air and Groundwater Monitoring, Additional Deep Wells, Contingency Plans.

Estimated Total Remedial Cost: \$5,685,020 Present Worth
Estimated Months to Implement: 12-24

To implement Alternative B, drums containing lead drosses and other production by-products would be removed to an off-site secondary lead smelter for lead recovery. Wastes contained in the SLIR piles would be consolidated into the Taracorp pile; the consolidated pile would be graded and capped with a multimedia cap. Institutional controls such as site access restrictions, restrictive covenants, deed restrictions, and property transfer restrictions would also be implemented.

Eagle Park Acres would be purchased and a vegetated clay cap in compliance with ARARs would be installed over the battery case material (refer to Figure 6). Institutional controls such as site access restrictions, restrictive covenants, deed restrictions, and property transfer restrictions would also be implemented.

Venice Alleys would be covered in accordance with present usage (refer to Figure 7). Asphalt would be applied to the portions subject to vehicular or pedestrian use; the remaining areas would be covered with 3 inches of topsoil followed by sod.

Unpaved portions of Areas 1, 2, and 3 (refer to Figure 4) would be covered in accordance with present usage. Asphalt would be applied to unpaved driveways and alleys; grassed or open areas would be covered with three inches of topsoil followed by sod. Removal of existing soils would be limited to driveway subgrade preparation; therefore, surface elevations would change somewhat depending on surface treatment. Any soil excavated would be transported to the Taracorp pile for use in grading prior to cap installation.

The air and groundwater monitoring included in the no action alternative would also be implemented as part of Alternative B.

Alternative C

Alternative C in the FS Report is nearly identical to Alternative D; therefore, Alternative C has been excluded from further consideration.

Alternative D

Taracorp Pile:	Multimedia Cap, Institutional Controls.
Taracorp Drums:	Off-Site Recovery at Secondary Lead Smelter.
SLIR Piles:	Excavate and Consolidate with Taracorp Pile.
Venice Alleys:	Excavate Case Material and Consolidate with Taracorp Pile. Restore Surfaces.
Eagle Park Acres:	Excavate Case Material and Consolidate with Taracorp Pile. Restore Surfaces.
Area 1 Unpaved Surfaces:	Excavate Soil and Consolidate with Taracorp Pile. Restore Surfaces.
Area 2 Unpaved Surfaces:	Excavate Soil and Consolidate with Taracorp Pile. Restore Surfaces.
Area 3 Unpaved Surfaces:	Excavate Soil and Consolidate with Taracorp Pile. Restore Surfaces.
Monitoring:	Air and Groundwater Monitoring, Additional Deep Wells, Contingency Plans.

Estimated Total Remedial Cost: \$6,835,450 Present Worth

Estimated Months to Implement: 12-24

To implement Alternative D, drums containing lead drosses and other production by-products would be removed to an off-site secondary lead smelter for lead recovery. Wastes contained in the SLIR piles would be consolidated into the Taracorp pile; the consolidated pile would be graded and capped with a multimedia cap. Institutional controls such as site access restrictions, restrictive covenants, deed restrictions, and property transfer restrictions would be implemented.

Battery case material would be excavated from both Venice Alleys and Eagle Park Acres and transferred to the Taracorp pile. After preliminary sampling is conducted, any portion of the case material that is EP Toxic for lead will be removed to an off-site, RCRA compliant landfill or treated prior to placement in the Taracorp pile. These areas would be restored with either asphalt or sod, in accordance with current usage.

Unpaved portions of Areas 1, 2, and 3 would be excavated to a depth of three inches and restored with either asphalt or sod, in accordance with present usage. Excavated soil would be transported to the Taracorp pile for use in grading prior to cap installation.

The air and groundwater monitoring included in the no action alternative would also be implemented as part of Alternative D.

Alternative E

Taracorp Pile:	Multimedia Cap, Supplemental Liner, Institutional Controls.
Taracorp Drums:	Off-Site Recovery at Secondary Lead Smelter.
SLLR Piles:	Excavate and Consolidate with Taracorp Pile.
Venice Alleys:	Excavate Case Material and Consolidate with Taracorp Pile. Restore Surfaces.
Eagle Park Acres:	Excavate Case Material and Consolidate with Taracorp Pile. Restore Surfaces.
Area 1 Unpaved Surfaces:	Excavate Soil and Consolidate with Taracorp Pile. Restore Surfaces.
Area 2 through 8 Residential Surfaces:	Excavate Soil and Consolidate with Taracorp Pile. Restore Surfaces.
Taracorp Pile.	
Monitoring:	Air and Groundwater Monitoring, Additional Deep Wells, Contingency Plans.

Estimated Total Remedial Cost: \$31,000,000 Present Worth

Estimated Months to Implement: 42-54

To implement Alternative E, drums containing lead drosses and other production by-products would be removed to an off-site secondary lead smelter for lead recovery. An impermeable liner would then be installed on a section of Area 1 adjacent to the Taracorp pile. All soils in Area 1 with lead concentrations greater than 1000 ppm would be excavated prior to liner installation, with the excavated soil staged with the Taracorp pile. The liner would consist of 2 feet of clay, 1 foot of sand (secondary drainage layer), a 60 mil synthetic membrane, and 1 foot of sand (primary drainage layer). A primary and secondary leachate collection system (perforated PVC piping) would also be provided. Excavated soils from Areas 1 through 8 would be placed over the primary drainage layer as a base to protect the liner from damage. Following liner construction, waste materials from the Taracorp pile, SLLR pile, Eagle Park Acres, and Venice Alleys would be excavated, transported to, and placed on the liner. These wastes would be covered and graded with soils excavated from the base of the former Taracorp pile. A multimedia cap would then be installed over the consolidated pile. All construction activities in Area 1 mentioned above would comply with any applicable flood plain construction permit

requirements. Institutional controls such as site access restrictions, restrictive covenants, deed restrictions, and property transfer restrictions would also be implemented.

As discussed above, battery case material would be excavated from both Venice Alleys and Eagle Park Acres and transferred to the newly constructed liner. These areas would be restored with either asphalt or sod, in accordance with current usage.

Residential soils in Areas 2 through 8 (see Figure 5) with lead concentrations greater than 500 ppm would be excavated and restored with either asphalt or sod, in accordance with present usage. As stated above, excavated soil would be transported to the newly constructed liner and placed directly over the primary drainage layer, to protect the synthetic membrane from damage from heavy slag and debris.

Air and groundwater monitoring included in the no action alternative would be implemented as part of Alternative E.

Alternative F

Taracorp Pile:	Multimedia Cap, Supplemental Liner Recovery of Plastic Battery Case Materials and Lead, Institutional Controls.
Taracorp Drums:	Off-Site Recovery at Secondary Lead Smelter.
SLIR Piles:	Excavate and Consolidate with Taracorp Pile.
Venice Alleys:	Excavate Case Material and Consolidate with Taracorp Pile. Restore Surfaces.
Eagle Park Acres:	Excavate Case Material and Consolidate with Taracorp Pile. Restore Surfaces.
Area 1 Unpaved Surfaces:	Excavate Soil and Consolidate with Taracorp Pile. Restore Surfaces.
Area 2 through 8 Residential Surfaces:	Excavate Soil and Consolidate with Taracorp Pile. Restore Surfaces.
Monitoring:	Air and Groundwater Monitoring, Additional Deep Wells, Contingency Plans.
Estimated Total Remedial Cost: \$45,000,000 Present Worth	
Estimated Months to Implement: 66-78	

Alternative F is identical to Alternative E, with the exception of recycling a portion of the waste materials as described below.

Prior to transport to the newly constructed liner, waste materials in the Taracorp pile would be processed to recover plastic battery case material and smeltable lead. During the initial excavation, waste material would be visually segregated: excavations containing primarily slag would be transported directly to the adjacent liner; those containing significant amounts of plastic battery case material and smeltable lead would be transported to an on-site

segregation unit. The commercially available unit would utilize flotation as a recovery mechanism. Recovered plastic would be shipped off-site for use as a raw material. Recovered lead and lead oxide would be shipped to a secondary smelter after drying. Residuals, including slag and rubber case material, would be transported to the liner.

Alternative G

Taracorp Pile:	Recovery of Plastic Battery Case Material and Lead, Disposal of Residuals in RCRA Landfill.
Taracorp Drums:	Off-Site Recovery at a Secondary Lead Smelter.
SLLR Piles:	Disposal in RCRA Landfill.
Venice Alleys:	Excavate Case Material, Disposal in RCRA Landfill. Restore Surfaces.
Eagle Park Acres:	Excavate Case Material, Disposal in RCRA Landfill. Restore Surfaces.
Area 1 Unpaved Surfaces:	Excavate and Restore. Disposal in RCRA Landfill.
Area 2 through 8 Residential Surfaces:	Excavate and Restore. Disposal in RCRA or Non-RCRA Landfill.
Monitoring:	Groundwater Monitoring, Additional Deep Wells, Contingency Plan.
Estimated Total Remedial Cost: \$67,000,000 Present Worth	
Estimated Months to Implement: 66-78	

To implement Alternative G, drums containing lead drosses and other production by-products would be removed to an off-site secondary lead smelter for lead recovery. The remaining waste materials in the Taracorp pile would be excavated, processed to recover recyclable plastic, and disposed of in a RCRA landfill.

Processing would consist of visual segregation during initial excavations to separate non-plastic bearing wastes from wastes containing plastics. Non-plastic bearing waste would be transported directly to the RCRA landfill; those containing significant amounts of plastic battery case material and smeltable lead would be transported to an on-site segregation unit. The commercially available unit would utilize flotation as a recovery mechanism. Recovered plastic would be shipped off-site for use as a raw material. Recovered lead and lead oxide would be shipped to a secondary smelter after drying. Residuals, including slag and rubber case material, would be transported to the RCRA landfill.

Battery case material would be excavated from both Venice Alleys and Eagle Park Acres and transported directly to the RCRA landfill. It is thought that these casings are primarily rubber and, therefore, not likely suitable for recycling. If significant amounts of plastic casings were excavated, however, they would be processed in the same fashion as the Taracorp pile casings. Venice Alleys

and Eagle Park Acres surface areas would be restored with either asphalt or sod, in accordance with current usage.

Unpaved portions of Areas 1 through 8 would be excavated and restored with either asphalt or sod, in accordance with present usage. Excavated soil from Area 1 would be transported to a RCRA landfill; excavated soil from Areas 2 through 8 would be transported to a RCRA or non-RCRA landfill, based on the results of preliminary EP Toxicity tests for lead.

The groundwater monitoring included in the no action alternative would also be implemented as part of Alternative G. Long term air monitoring would not be required.

Alternative H

Taracorp Pile:	Multimedia Cap, Institutional Controls.
Taracorp Drums:	Off-Site Recovery at a Secondary Lead Smelter.
SLIR Piles:	Excavate and Consolidate with Taracorp Pile.
Venice Alleys:	Excavate Case Material and Consolidate with Taracorp Pile. Restore Surfaces.
Eagle Park Acres:	Excavate Case Material and Consolidate with Taracorp Pile. Restore Surfaces.
Area 1 Unpaved Surfaces:	Excavate Soil and Consolidate with Taracorp Pile. Restore Surfaces.
Areas 2 through 8 Residential Surfaces:	Excavate Soil and Consolidate with Taracorp Pile. Restore Surfaces.
Monitoring:	Air and Groundwater Monitoring, Additional Deep Wells, Contingency Plans.
Estimated Total Remedial Cost: \$25,000,000 Present Worth	
Estimated Months to Implement: 18-30 (construction)	

Alternative H, which was added by U.S. EPA and IEPA in an addendum to the draft FS Report, is identical to Alternative D, with the exception that the scope of off-site soil and waste materials excavation is increased significantly as described below. NL Industries has indicated to U.S. EPA its objections to the increased scope of soil excavation in this alternative.

All soils in Area 1 with lead concentrations greater than 1000 ppm and residential soils in Areas 2 through 8 with lead concentrations greater than 500 ppm would be excavated and consolidated with the Taracorp pile. Surfaces would be restored with either asphalt or sod, in accordance with present usage.

VIII. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The nine criteria used for evaluating the remedial alternatives listed above include: overall protection of human health and the environment; compliance with ARARs; long-term effectiveness; reduction of toxicity, mobility, or

acceptance; volume; short-term effectiveness; implementability; cost; State of Illinois acceptance and communities of Granite City, Madison, and Venice, Illinois acceptance. Based on these nine criteria, the U.S. EPA and IEPA have selected Alternative H, as modified with five additional elements added due to public comments received, as the preferred alternative for remedial action at the NL site. The preferred alternative includes: Blood Lead Sampling in the Neighboring Communities/Removal and Recovery of Taracorp Drums/Consolidation of SLLR Piles Into Taracorp Pile/Excavation and Restoration Of Unpaved Portions Of Area 1 With Lead Concentration Greater than 1000 ppm and Residential Areas Around The Site and in Venice, Eagle Park Acres, and Other Nearby Communities with Lead Concentration Greater Than 500 ppm, and Consolidation of These Soils and Battery Case Materials with the Taracorp Pile or Off-Site Disposal/Excavation, Restoration and Consolidation With Taracorp Pile or Off-Site Disposal of Battery Case Material in Alleys and Driveways in Venice, Eagle Park Acres, and Other Nearby Communities/Construction of a RCRA-Compliance Cap Over the Expanded Taracorp pile and a Clay Liner Under All Newly-Created Portion of the Expanded Taracorp Pile/Construction of a RCRA-Compliant Cap Over the Expanded Taracorp Pile/Inspection of Home Interiors/Establishment of Contingency Measures To Properly Dispose of Contaminated Soil Generated Through Changes In Land Use/Installation of Deep Monitoring Wells/Cap, Air and Groundwater Monitoring And Contingency Plans/Fencing and Institutional Controls. Refer to Figure 8 for a diagram of the RCRA-compliant, multimedia cap to be placed over the Taracorp pile, after consolidation. This section discusses the performance of the preferred alternative against the nine criteria, noting how it compares to the other options under consideration.

It must be noted that the comparisons made below are for the alternatives as discussed in the Proposed Plan. Due to comments received during the public comment period, five elements were added to Alternative H, namely blood lead sampling in the surrounding community, home interior inspections on properties to be excavated, provisions to remediate additional areas in Eagle Park Acres, Venice, Granite City, Madison and other nearby communities where battery case materials are located at or near the surface and which were not identified in the draft FS Report, construction of a clay liner under the new newly-created portions of the expanded Taracorp pile, and establishment of contingency measures to provide for proper disposal of contaminated soil due to land use changes within the zone of contamination. The selected remedy, or preferred alternative, is Alternative H as modified by the addition of these five elements. These elements are not discussed in the analysis below since, with the exception of Alternative A and Alternative B and G, for which a liner would not be required, they would be included in each of the alternatives. Additionally, cost estimates have not been provided for these elements; however, it is expected that, excluding the contingency measures, these activities will not cost more than 15% of the cost estimates for the alternatives provided in this ROD. It is difficult to provide a cost estimate for the contingency measures; however, it is expected that the cost of these measures would be the same for each alternative which remediates residential soils. Finally, it must be noted that Figures 5, 6, and 7 represent only estimated areas of remediation and that the extensive soil sampling and inspections provided as part of the preferred alternative will result in the accurate delineation of areas of remediation during the upcoming Remedial Design phase of the Superfund process.

ANALYSIS

Overall Protection - With the exception of the no action alternative, the treatment of Areas 4 through 8 in Alternative B, and the treatment of Areas 1 through 8 in Alternative D, all of the alternatives, as amended by the addendum to the Feasibility Study, would provide adequate protection of human health and the environment. Each of the alternatives found adequately protective of human health and the environment includes a residential soil lead cleanup standard of 500 ppm and a soil lead cleanup standard of 1000 ppm in Area 1. Levels of protectiveness are based on interim guidance and site specific analysis of Granite City and the surrounding communities (see Appendix B). The preferred alternative includes the elimination of direct contact with and inhalation of soils and waste materials contaminated with lead at concentrations above levels which may present a risk to public health by: removal of Taracorp drums and off-site recovery at a secondary lead smelter; excavation, restoration, and consolidation with the Taracorp pile of the SLIR piles, soils and battery case materials with lead concentrations greater than 500 ppm in residential areas in Areas 2 through 8, and battery case material in Venice Alleys and Eagle Park Acres; excavation, restoration, and consolidation of soils and waste materials in Area 1 with lead concentrations greater than 1000 ppm; and providing a multimedia cap over the Taracorp pile and providing institutional controls. The preferred alternative also includes installation of additional deep wells, air and groundwater monitoring plans, and contingency plans to be developed and implemented in the event that site-related contaminant levels in the air or groundwater exceed applicable standards or that materials in the expanded Taracorp pile become exposed or releasable to the air in the future.

Compliance with ARARs - Alternatives B through H would meet all Applicable or Relevant and Appropriate Requirements (ARARs) of Federal and State Environmental Laws except for State of Illinois General Use Water Quality Standards (35 IAC 302.208). These standards are applicable to groundwater beneath the site and are exceeded for sulfates, total dissolved solids, iron, manganese and zinc. The standards for these parameters were developed to ensure the aesthetic quality of water and concentrations in excess of the General Use standards for these parameters would not present a health concern. Cadmium was also present above the General Use standard during three rounds of sampling but not during the most recent sampling. The groundwater monitoring and additional deep well installation included in all alternatives will verify cadmium concentrations and monitor concentrations of all other parameters of concern. Care would have to be exercised with Alternatives E, F, and G to ensure that Taracorp pile excavation activities do not create exceedances of air ARARs.

Additionally, the consolidation of excavated contaminated soils from the residential areas around the site is included in Alternatives D and H due to the fact that these areas are within a zone of continuous contamination created by the airborne deposition of lead from the smelter stack throughout its years of operation. Lead contamination is highest next to the smelter stack (on-site) and gradually decreases with increasing radial distance from the stack, and the nearest residential areas to be excavated are physically separated from the site boundary by one roadway, 16th Avenue.

Long-Term Effectiveness - Alternatives E, F, and G would provide good long-term effectiveness against direct contact with and inhalation of soils and waste materials containing lead concentrations above levels which may present a risk to public health, as well as an additional barrier against leaching of lead and other metals into the groundwater. The preferred alternative (i.e., Alternative H) would provide similar long-term effectiveness but would not provide the additional barrier (bottom clay liner) against leaching metals under the present Taracorp pile; however, the groundwater does not represent a complete risk pathway at this site. With the exception of Areas 4 through 8, for which no remediation is provided, Alternative B would eliminate the risk of human exposure in off-site areas upon completion of remediation but would not provide long-term effectiveness in these areas due to maintenance requirements and the potential for uncontrolled excavation. With the exception of Areas 4 through 8, for which no remediation is provided, Alternative D would provide good long-term effectiveness with respect to materials consolidated with the Taracorp pile; however, at Areas 1, 2, and 3, lead concentrations at 3 inches beneath the ground surface would remain at levels which may present a risk to public health. The no action alternative allows waste materials to remain in place and, thus, has poor long-term effectiveness.

Reduction of Toxicity, Mobility, or Volume - With the exception of the no action alternative, all alternatives provide a reduction of mobility of contaminants; the degree of mobility reduction provided, from least to greatest, is Alternative B, D, H, E, F, then G. The no action alternative does not provide any reduction of toxicity or volume, Alternatives B, D, H, and E provide a slight reduction of toxicity and volume by removal and recovery of Taracorp drums, and Alternatives F and G provide a slightly greater reduction of toxicity and volume by recycling some waste materials. The reduction of volume effected by Alternatives F and G has been calculated to be less than 10%, based on the quantity, nature and physical condition of recyclable materials in the Taracorp pile. A recycling effort on the Taracorp pile was conducted in the early 1980's by St. Louis Lead Recyclers. The effort was unsuccessful in that anticipated volume reductions were not achieved and the material remaining after recycling was more contaminated than that which entered the process. The nature of the materials in the Taracorp pile is not conducive to a successful recycling effort, and will potentially create a greater adverse health impact to workers and the public than would exist if the materials remain in place. Treatment/stabilization has been applied to contaminated soils at other sites, but has not been successfully applied to waste materials such as exist in the Taracorp pile. Additionally, Alternatives F and G would produce a contaminated sludge as a result of precipitation of rinse waters used for recycling.

Short-Term Effectiveness - Implementation of Alternatives A and B would produce minimal short-term impacts to the community, workers, or the environment, as contaminated material would be left in place. Implementation of Alternatives D, E, F, G, and H could generate dust in residential and commercial areas, which would require monitoring and control. Alternative D would be of shorter duration and would involve the movement of less materials than Alternative H, which would in turn involve less materials movement than Alternatives E, F, and G. Alternatives E, F, and G include significant excavation at the Taracorp pile; the generated dust could impact the

community, workers, and the environment. Control measures would be required. Alternatives F and G also include extensive manual handling of waste materials at the Taracorp pile; worker health and safety could be jeopardized through ingestion of and direct contact with lead containing materials.

The following periods of time are required to implement the remedial construction activities for each alternative:

<u>Alternative</u>	<u>Time</u>
A	6-12 Months
B, D	1-2 Years
H	Approximately 2 1/2 Years
E	3 1/2 - 4 1/2 Years
F, G	5 1/2 - 6 1/2 Years

Implementability - Alternatives A, B, D, and H would utilize standard monitoring and construction techniques which would be readily implementable. The excavation of the Taracorp pile and other soils and waste materials incorporated in Alternatives D, E, F, G, and H would require dust control measures. The segregation and recovery utilized by Alternatives F and G, however, would utilize equipment designed to handle batteries, not the slag and waste materials present at the Taracorp pile. In addition, the recovered products may not be suitable for recycling: the recovered plastic may not pass the TCLP test for lead, and the lead content of the recovered slag/dirt/lead mixture may not be high enough to be acceptable to a secondary smelter.

Cost - The costs of each alternative are presented below. It must be noted that these are estimated costs. More detailed cost estimates will be prepared during the Remedial Design phase of the project.

<u>Alternative</u>	<u>Capital Cost</u>	<u>O&M</u>	<u>Present Worth</u>
A	\$143,840	\$21,550	\$475,110
B	\$5,142,390	\$35,300	\$5,685,020
D	\$6,292,820	\$35,300	\$6,835,450
E	\$30,500,000	\$35,300	\$31,000,000
F	\$44,500,000	\$35,300	\$45,000,000
G	\$66,500,000	\$5,300	\$67,000,000
H	\$24,500,000	\$35,300	\$25,000,000

State Acceptance - The State of Illinois supports the preferred alternative.

Community Acceptance - Community acceptance of the preferred alternative has been evaluated and it has been determined that the following five elements should be added to the preferred alternative: 1) blood lead sampling in the surrounding community, 2) home interior inspections on properties to be excavated, 3) provisions to remediate additional areas in Eagle Park Acres, Venice, Granite City, Madison, and other nearby communities where battery case materials are located at or near the surface and which were not identified in the draft FS Report, 4) construction of a clay liner under the newly-created portions of the expanded Taracorp pile and 5) establishment of contingency

measures to provide for proper disposal of contaminated soil due to land use changes within the zone of contamination. The Responsiveness Summary is included in Appendix A of this Record of Decision and addresses all comments received during the 60 day public comment period.

IX. THE SELECTED REMEDY

The preferred alternative (selected remedy) for cleaning up the NL Site is Alternative H, as amended by the addition of the five elements listed above: Blood Lead Sampling In the Neighboring Communities/Removal and Recovery of Taracorp Drums/Consolidation of SLIR Piles Into Taracorp Pile/Excavation and Restoration Of Unpaved Portions Of Area 1 With Lead Concentration Greater than 1000 ppm and Residential Areas Around The Site and in Venice, Eagle Park Acres, and Other Nearby Communities With Lead Concentration Greater than 500 ppm, and Consolidation of These Soils and Battery Case Materials with the Taracorp Pile/Excavation, Restoration and Consolidation With Taracorp Pile, or Off-site Disposal, of Battery Case Material in Alleys and Driveways in Eagle Park Acres, Venice, and Other Nearby Communities/Construction of a RCRA-Compliant Cap Over the Expanded Taracorp Pile and Clay Liner under all Newly-Created Portions of the Expanded Taracorp Pile/Inspection of Home Interiors/Establishment of Contingency Measures To Properly Dispose of Contaminated Soil Generated Through Changes In Land Use/Installation of Deep Monitoring Wells/Cap, Air and Groundwater Monitoring and Contingency Plans/Fencing and Institutional Controls. Based on current information, this alternative provides the best balance of trade-offs among the alternatives with respect to U.S. EPA's nine evaluation criteria.

Soil Sampling/Inspection

Soil lead sampling shall be conducted in Area 1 and all residential portions of Areas 2-8 (Figure 5) and immediately adjacent properties to determine the depth to which each individual residential yard must be excavated to achieve a 500 ppm soil lead cleanup level and the depth to which Area 1 must be excavated to achieve a 1000 ppm cleanup level.

Inspections of alleys and driveways and areas containing surficial battery case materials in Eagle Park Acres, Venice, Granite City, Madison, and other nearby communities shall be conducted to determine which specific areas not already identified in Figures 5, 6 and 7 need remediation. EP toxicity sampling for lead shall be conducted for all identified areas, and lead sampling of all identified areas which are not alleys or driveways shall be conducted to determine the depth to which such areas must be excavated to achieve a 500 ppm cleanup level.

Blood Lead Study

A comprehensive blood lead study shall be conducted on a representative number and distribution of residents nearby the site. Results shall be provided to the community as soon as possible. The study will be coordinated with and/or conducted by the Agency for Toxic Substances and Disease Registry and/or Illinois Department of Public Health and shall be conducted during optimum exposure time (i.e. summer 1990).

Taracorp Drums

All drums on the Taracorp pile shall be removed and transported to an off-site secondary lead smelter for lead recovery.

SLIR Pile

All wastes contained in the SLIR pile shall be consolidated into the Taracorp pile.

Alleys and Driveways in Venice and Eagle Park Acres

Based upon the FS and the inspections outlined above, battery case material shall be excavated from all alleys and driveways in Venice, Eagle Park Acres, and other nearby communities in which it has come to be located at or near the surface. Sampling for EP toxicity for lead shall be conducted in all affected areas prior to removal of the case material. All excavated material which is not EP toxic for lead shall be transported to the Taracorp pile for consolidation. All excavated material which is EP toxic for lead shall be transported to an off-site RCRA-compliant landfill or treated prior to placement in the Taracorp pile. Excavated areas shall be backfilled, if necessary, and paved.

Area 1

Based on the sampling outlined in the Soil Sampling/Inspection paragraph above, all unpaved portions of Area 1, including the material which is beneath the SLIR pile, with lead concentrations greater than 1000 ppm shall be excavated and consolidated with the Taracorp pile. The surfaces shall be restored with asphalt or sod, in accordance with present usage.

Residential Areas

Based on the sampling outlined in the Soil Sampling/Inspection paragraph above, an accurate mapping of all residential areas around the site and in Eagle Park Acres, Venice, and other nearby communities with a lead concentration greater than 500 ppm shall be provided. All soils and battery case materials with lead concentrations greater than 500 ppm in the residential areas indicated on the map shall be excavated and consolidated with the Taracorp pile, with the exception of soils and battery case materials in Eagle Park Acres, Venice, and other nearby communities which are EP toxic for lead, which shall be transported to an off-site RCRA-compliant landfill or treated prior to placement in the Taracorp pile. The surfaces shall be restored in accordance with present usage. Every effort shall be made to remediate sensitive areas (school yards, playgrounds, areas with highest lead concentrations, etc) first, and no trees or structures or large vegetation shall be removed.

Home Interior Inspection

During the excavation of each residential yard, an inspection of the interior of each home shall be conducted to identify possible sources of lead exposure.

The results and recommendations of each inspection shall be provided to the appropriate residents.

Dust Control Measures

During all excavation, transportation, and consolidation activities conducted as part of the remedy, dust control measures shall be implemented as necessary to prevent the generation of visible emissions during these activities.

RCRA-Compliant Multimedia Cap

After all materials have been transported to and consolidated with the Taracorp pile, the consolidated pile shall be graded and capped with a RCRA-compliant, multimedia cap. The cap shall be constructed as indicated in Figure 8 and shall meet or exceed the requirements of RCRA Subtitle C, and Illinois State law. The proposed construction does not lie within any floodway in the area.

Bottom Liner

With the exception of the existing Taracorp pile, a clay bottom liner shall be constructed on all areas upon which consolidated materials are to be placed as part of this remedy. Portions of this liner on Area 1 shall be constructed after Area 1 has been excavated to a 1000 ppm lead cleanup level.

Institutional Controls/Fencing

Institutional controls, such as site access restrictions, restrictive covenants, deed restrictions, and property transfer restrictions, shall be implemented for the properties which contain the expanded Taracorp pile to prohibit future development of the site and any activities that would in any way reduce the effectiveness of the cap in achieving remedial action goals.

The facility shall be fenced in a manner sufficient to prevent access to the expanded Taracorp pile. Warning signs shall be posed at 200-foot intervals along the fence advising that the area is hazardous due to chemicals in the waste materials and soils beneath the cap which may pose a risk to public health.

Groundwater Monitoring

A minimum of one upgradient and three downgradient deep wells shall be installed to monitor water quality in the lower portion of the upper aquifer. Monitoring of these wells and the 14 existing site wells shall be conducted semi-annually for a minimum of 30 years and analyses shall be performed for the full scan Hazardous Substance List organics and inorganics. After four sampling events, consideration shall be given to deleting parameters from the list which are below detection limits for all four events.

Air Monitoring

Air monitoring for lead and PM₁₀ (particulate matter less than 10 microns) shall be performed annually at a minimum of two locations adjacent to the site for a minimum of 30 years.

Cap Monitoring

For a minimum of 30 years, annual inspections of the cap shall be conducted to identify areas requiring repair. Appropriate maintenance shall be conducted immediately following the inspections.

Contingency Plans

Contingency Plans for air, groundwater and the cap/soil cover shall be developed to provide remedial action in the event that concentrations of contaminants in groundwater or lead or PM₁₀ in air exceed applicable standards or established action levels or that waste materials have migrated to the surface or become releasable to the air in the future.

Other Contingency Measures

Contingency measures shall be established to provide for sampling and removal of any soils located within the zone of contamination established pursuant to the Soils Sampling/Inspection paragraph above with lead concentrations above 500 ppm which are presently capped by asphalt or other barriers but become exposed in the future due to land use changes or deterioration of the existing use.

X. STATUTORY DETERMINATIONS

Based on the information available at this time, U.S. EPA and IEPA believe this alternative will satisfy statutory requirements to: protect human health and the environment, attain ARARs, be cost-effective, utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

Protectiveness

The selected remedy will be adequately protective of human health and the environment. Removal of soils and battery case materials in residential areas above 500 ppm lead, soils and waste materials in Area 1 above 1000 ppm, and battery case materials in alleys and driveways, and restoration through applications of sod, paving, etc. will eliminate direct contact with and inhalation of dust and lead contaminated soils and waste materials which may create a risk to human health and the environment. Inspection of the interiors of homes and providing residents with recommendations to minimize exposure to potential indoor contamination will add an additional measure of reduction of direct contact and inhalation of dust and contaminated soils. Consolidation of the SLR pile and soils and waste materials removed from the excavations described above with the Taracorp pile and capping of the resulting, expanded Taracorp pile, or off-site disposal of the above mentioned soils and waste materials, will bring all contaminated materials to a central location and provide a barrier against direct contact and dust generation from the waste materials. The cap, along with the bottom liner to be constructed under all newly-created portions of the expanded Taracorp pile, will also provide a barrier against leaching of contaminants from the expanded Taracorp pile. Transporting EP toxic soils and battery case material from Venice, Eagle Park

Acres, and other nearby communities to a RCRA-compliant landfill or treating these soils prior to placement in the Taracorp pile will also provide proper management of these materials to provide a barrier against direct contact and dust generation and leaching of contaminants into the groundwater. Additional measures to prevent exposure to contaminated waste materials and soil included in the selected remedy are: site fencing and institutional controls; groundwater, air, and cap monitoring and associated contingency plans; and establishment of contingency measures to provide for appropriate disposal of soils within the zone of contamination with lead concentrations above 500 ppm. Removal of drums on the Taracorp pile will allow these waste materials to be recycled in a secondary lead smelter. Finally, a blood lead study will provide current, useful information to residents in the vicinity of the site with respect to any acute health effects that may be present due to exposure to the contaminated soils and waste materials at and around the site.

Attainment of Applicable or Relevant and Appropriate Requirements

The Superfund Amendments and Reauthorization Act (SARA) requires that remedial actions meet legally applicable or relevant and appropriate requirements of other environmental laws. These laws may include: the Toxic Substances Control Act, the Safe Drinking Water Act, the Clean Air Act, the Clean Water Act, the Resource Conservation and Recovery Act (RCRA), and any state law which has stricter requirements than the corresponding federal law.

A "legally applicable" requirement is one which would legally apply to the response action if that action were not taken pursuant to Section 104 or Section 106 of CERCLA. A "relevant and appropriate" requirement is one that, while not "applicable", is designed to apply to problems sufficiently similar that its application is appropriate.

In addition to ARARs, many Federal and state environmental and public health programs also develop criteria, policies, guidance, and proposed standards that are not legally applicable, but that may provide useful information or recommended procedures (referred to as "To Be Considered" criteria (TBC)). These guidance or policy documents may be considered and used as appropriate, where necessary to ensure protectiveness. If no ARARs address a particular situation, TBC policies, criteria or guidelines should be used to set cleanup targets.

ARARs and TBC criteria have been identified for the NL Site. Discussed below are the primary ARARs and TBC criteria and how the selected remedy complies with them.

° RCRA Subtitle C Cap

The State of Illinois has jurisdiction for RCRA Subtitle C, hazardous waste landfill operation and closure laws. This is covered by 35 IAC Part 724, standards for owners and operators of Hazardous Waste Treatment, Storage and Disposal Facilities. This regulation applies to owners or operators of waste piles that are closed with wastes left in place. The regulation seeks to minimize infiltration by specifying clay type and to promote drainage by

specifying sloping and topsoil requirements. Closure of the expanded Taracorp pile shall be conducted in accordance with 35 IAC Part 724, subpart N; Landfills. These requirements are ARARs for the capping of the expanded Taracorp pile.

- ° Lead, PM₁₀, and Fugitive Dust Emissions During and After Construction and Post-Construction Monitoring/Contingency Plan

The State of Illinois has jurisdiction for Ambient Air Quality Standards and Measurement Methods for Lead and PM₁₀ and requirements for fugitive particulate matter. This is covered by 35 IAC Part 212, Subpart B for lead and PM₁₀ and 35 IAC Part 212, subpart K for fugitive particulate matter. Construction activities and post-construction monitoring shall be conducted in a manner that will achieve compliance with these requirements, which are ARARs for these activities.

- ° Groundwater Contingency Plan Action Levels

The State Of Illinois General Use Water Quality Standards which are covered by 35 IAC Part 302, Subpart B, also apply to the groundwater at the NL site. Action levels for the Groundwater Contingency Plan shall be adopted from the Maximum Contaminant Levels (MCLs) and the General Use Water Quality Standards. Groundwater contingency plans will be triggered if concentrations of contaminants in the groundwater exceed action levels at the points of compliance.

- ° Soil Lead Cleanup Level

Due to the fact that there is no promulgated soil lead cleanup standard and that a complete quantitative risk assessment cannot be performed at this time (see Appendix B for detailed explanation), the September 7, 1989 "Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites" is a TBC criteria for this site. This guidance basically recommends a residential soil total lead cleanup level at 500 to 1000 ppm. The selected remedy, which utilizes a 500 ppm residential soil cleanup level, complies with this guidance.

Cost Effectiveness

The selected remedy is implementable and provides the elimination of direct contact with and inhalation of soils and waste materials contaminated with lead at concentrations above levels which may present a risk to public health in a comparable or smaller time frame and cost than other alternatives which achieve this goal.

Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable, in that it would remove contaminated soils and waste materials from areas where maximum human exposure would occur and provide recycling of the Taracorp drums. Due to the nature of contaminated waste materials in the Taracorp pile and SLR piles, the

relatively low concentrations of lead in the contaminated soils, and the lack of downgradient groundwater contamination at the site, this remedy represents the maximum extent to which permanent solutions and treatment can be practicably utilized.

Preference for Treatment as a Principle Element

The selected remedy satisfies the statutory preference for remedies that employ treatment that achieves substantial risk reduction through recycling of the Taracorp drums and by providing safe management of waste materials and soils that will be consolidated and remain at the site.

No treatment is provided for the Taracorp pile and SLIR piles because, although treatment has been provided for lead contaminated soils and certain lead waste materials at other Superfund sites, the quantity, nature, and physical condition of waste materials in the Taracorp pile create a situation where very little volume reduction can be achieved, stabilization is not feasible, and treatment will create a significant potential risk to workers and the community during implementation but will not achieve an appreciable volume reduction or reduction in mobility. The soils and battery case materials from residential areas and alleys and driveways to be consolidated with the Taracorp pile will not be EP toxic for lead. This, in conjunction with the fact that no downgradient groundwater contamination has been detected at the site, make treatment of these materials unnecessary and impractical. Soils and battery case materials which are EP toxic for lead will be treated prior to consolidation with the Taracorp pile or will be disposed off-site. However, because this remedy will result in hazardous substances remaining on-site above health-based levels (the expanded Taracorp pile), a review will be conducted every five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. The monitoring and contingency plans provided in the remedy will help to achieve this goal.

FIGURE 1

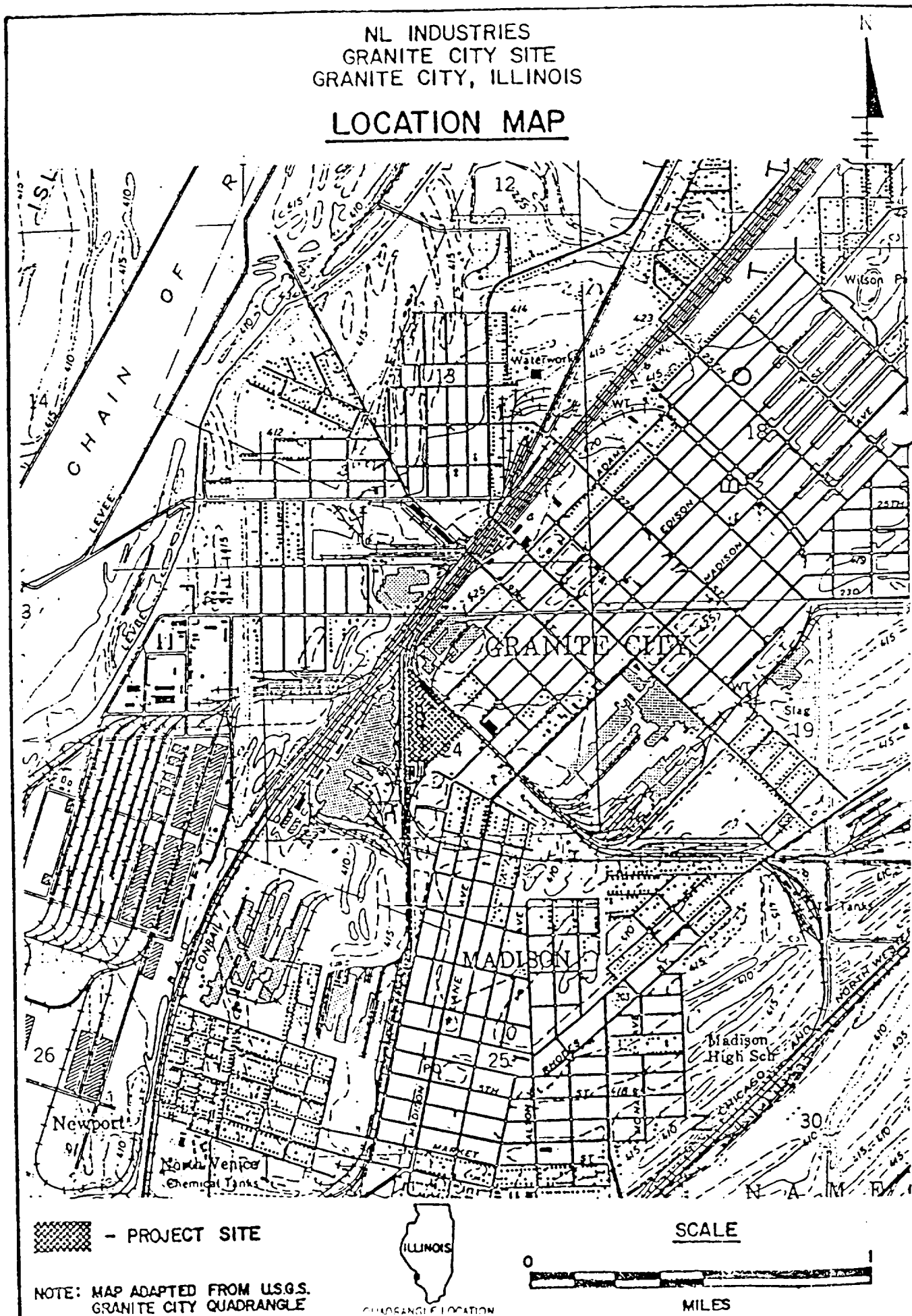
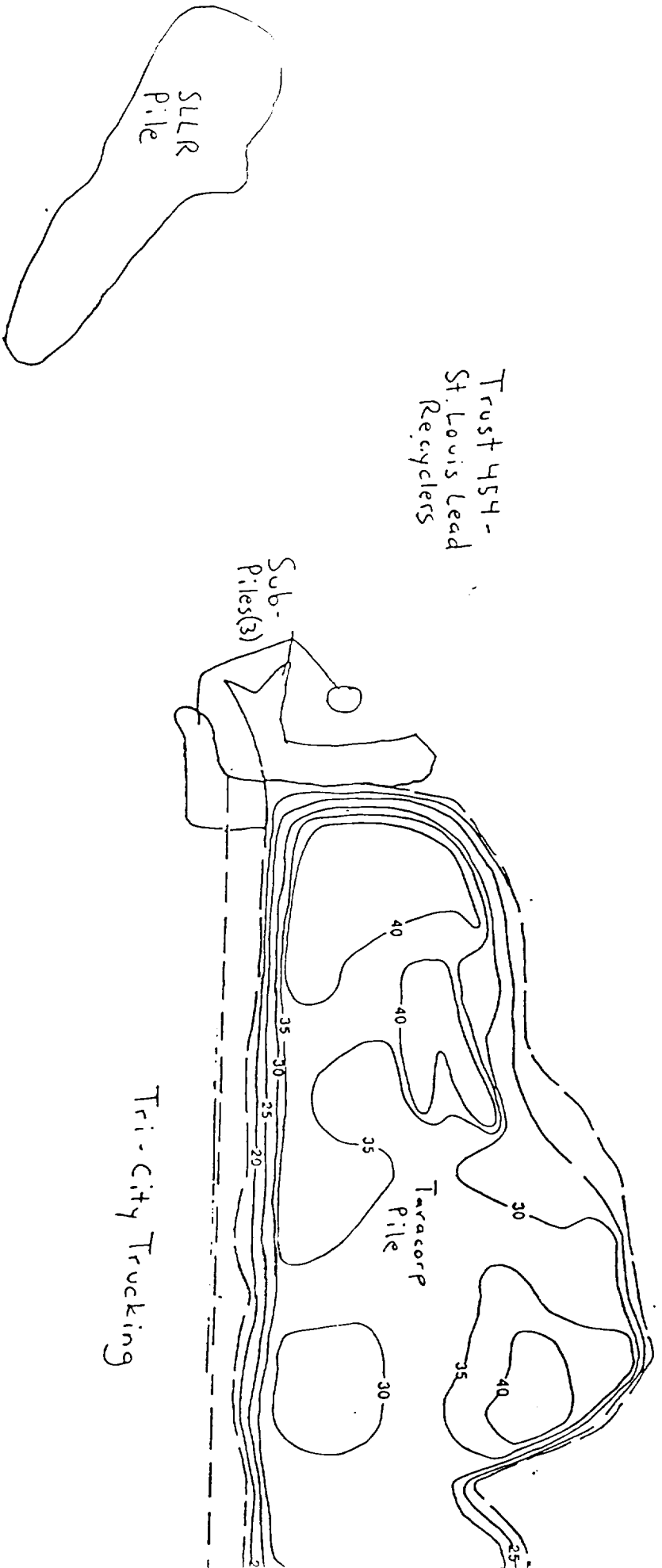
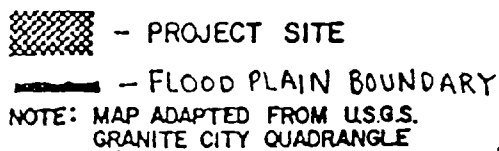


Figure 2
Site Plan - Waste Pile



NL INDUSTRIES
GRANITE CITY SITE
GRANITE CITY, ILLINOIS
Flood Plain in the
Vicinity of the Site



QUADRANGLE LOCATION

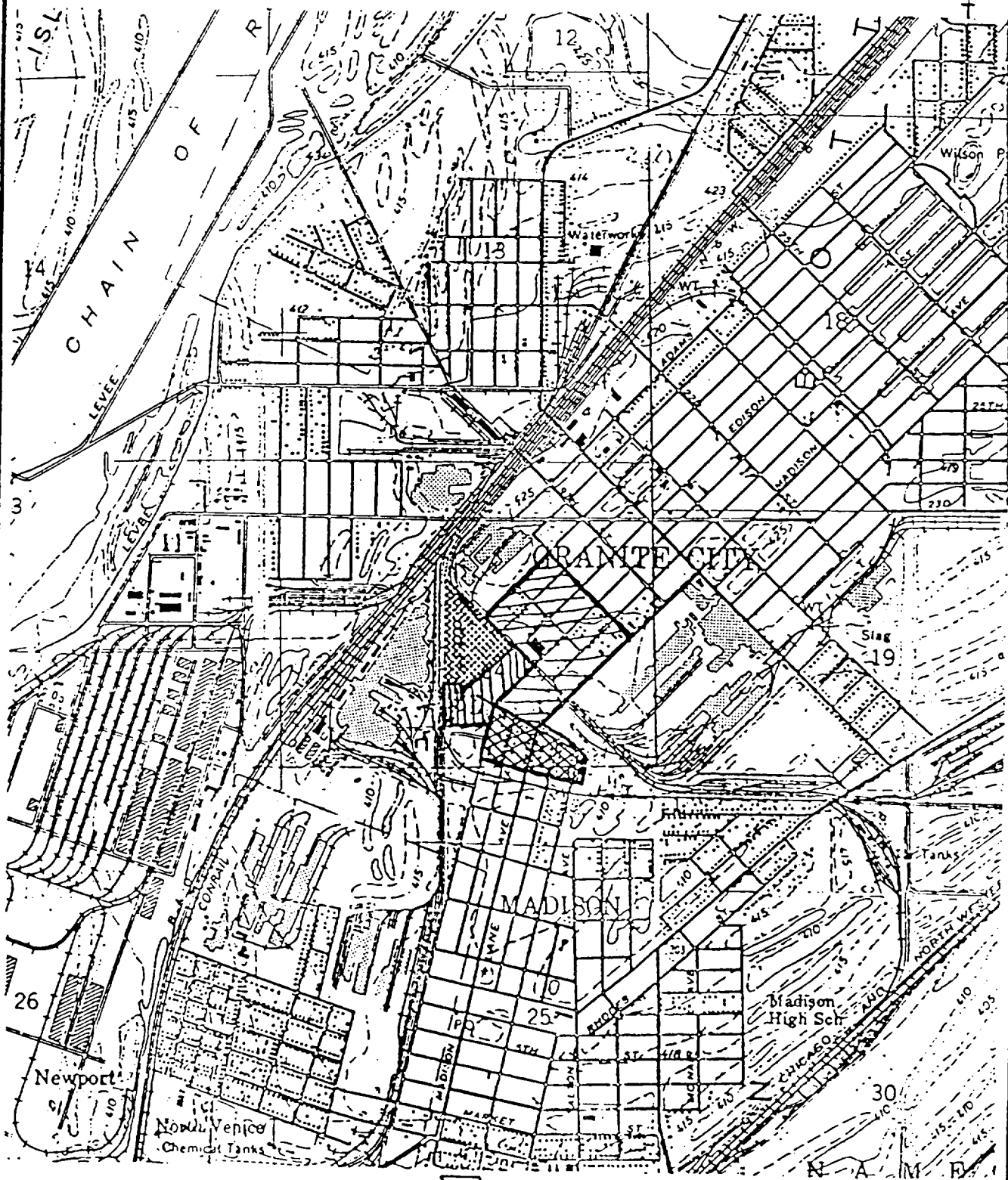
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MILES

MILES

Figure 4
 GRANITE CITY SITE
 GRANITE CITY, ILLINOIS

Areas 1, 2, and 3



-  - PROJECT SITE
-  - Area 2
-  - Area 1
-  - Area 3

NOTE: MAP ADAPTED FROM U.S.G.S.
 GRANITE CITY QUADRANGLE

QUADRANGLE LOCATION

SCALE



MILES

Figure 5

NL INDUSTRIES
GRANITE CITY SITE
GRANITE CITY, ILLINOIS
Estimated Areas of Lead Contamination
Above 500 ppm

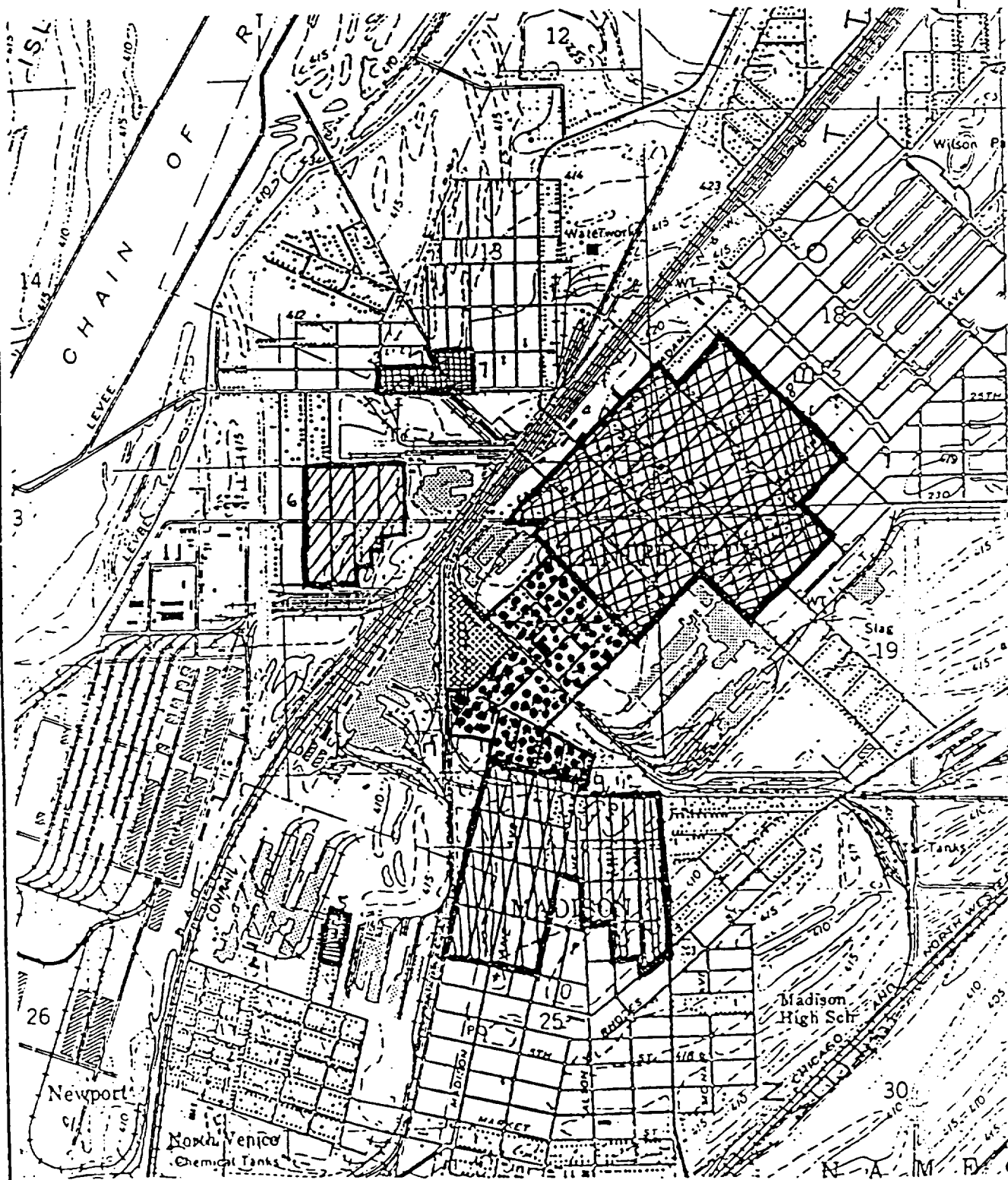
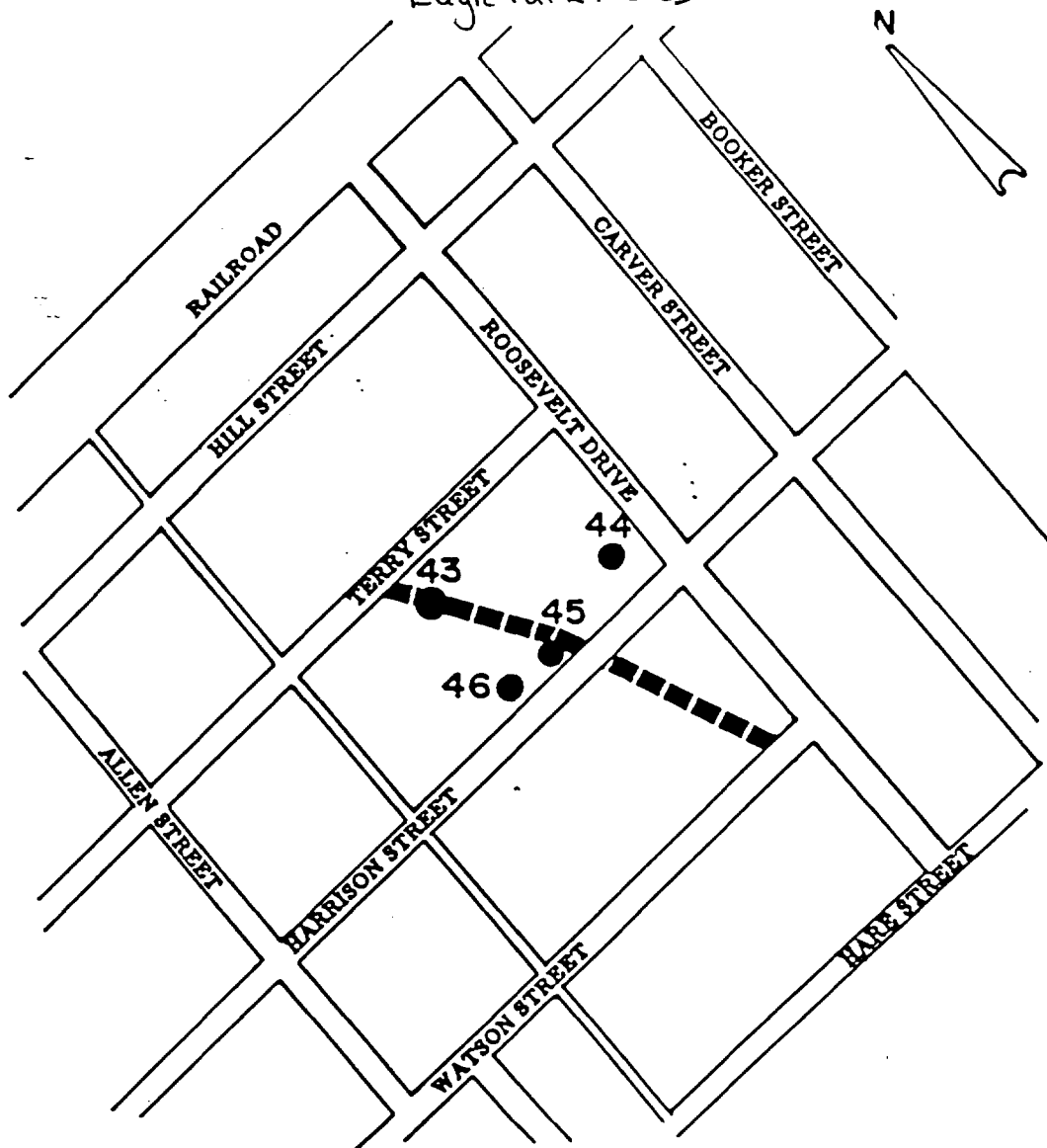


Figure 6
Estimated Areas of Contamination
Eagle Park Acres



REMOTE FILL AREA

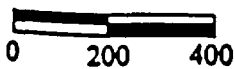
EAGLE PARK ACRES

LEGEND

● SOIL SAMPLE LOCATION

■■■ APPROXIMATE LOCATION OF DITCH

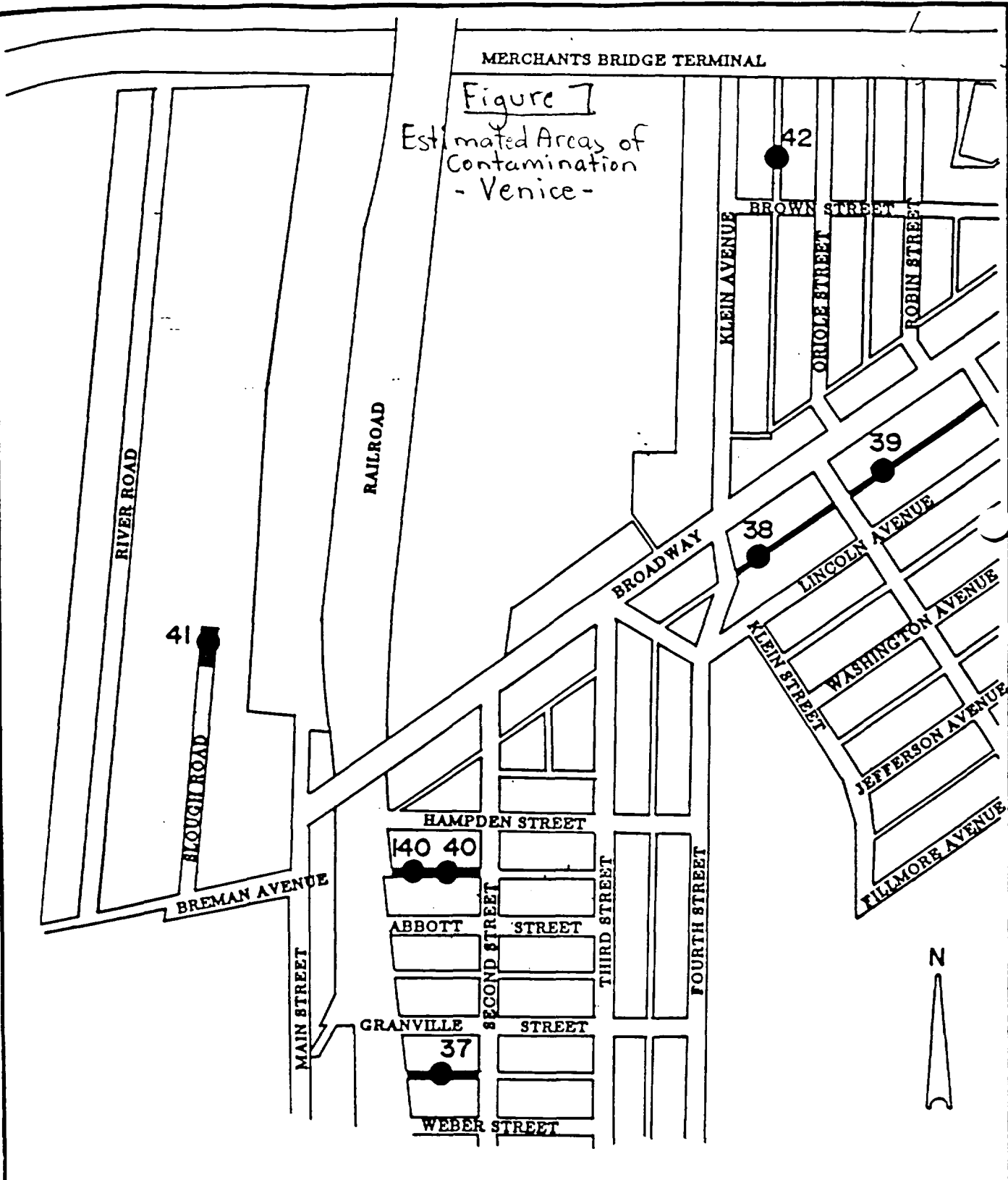
SCALE



MERCHANTS BRIDGE TERMINAL

Figure 7

Estimated Areas of Contamination - Venice -



REMOTE FILL AREA

VENICE

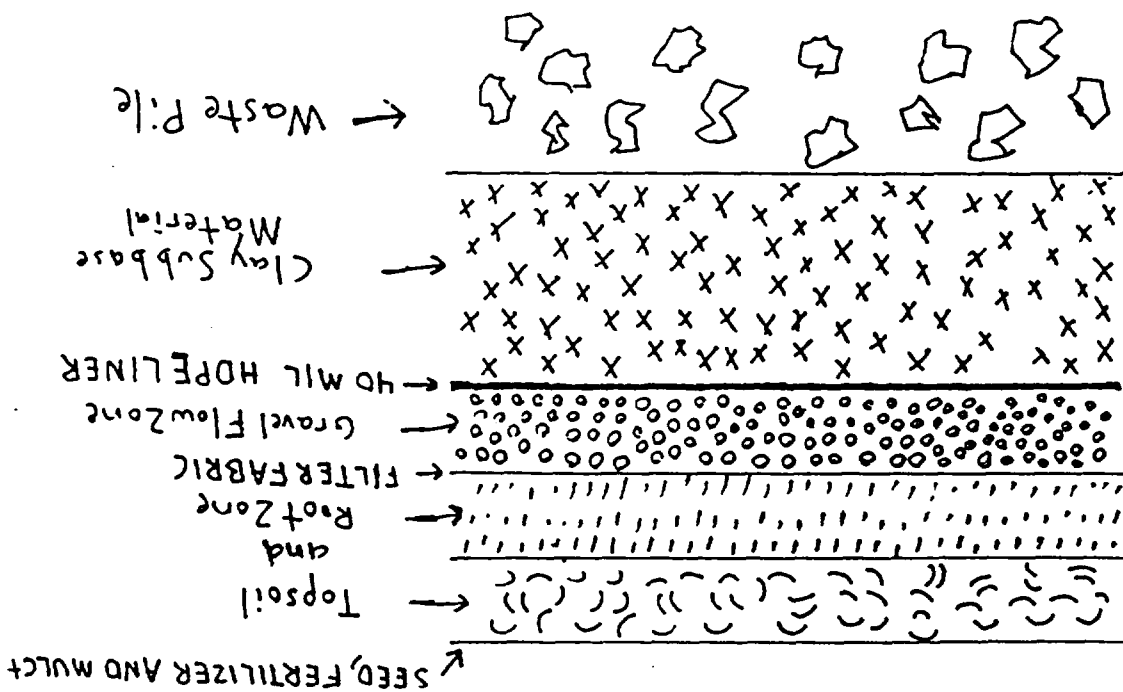
LEGEND

- SOIL SAMPLE LOCATION
- PROPOSED REMEDIATION SITES

SCALE

0 200 400

Figure 8
Multimedia Cap Detail



Appendix A

NL INDUSTRIES\TARACORP GRANITE CITY, ILLINOIS RESPONSIVENESS SUMMARY

I. RESPONSIVENESS SUMMARY OVERVIEW

In accordance with CERCLA Section 117, a public comment period was held from January 10, 1990 to March 12, 1990, to allow interested parties to comment on the United States Environmental Protection Agency's (U.S. EPA's) Feasibility Study (FS), FS Addendum, and Proposed Plan for a final remedy at the NL Industries\Taracorp Superfund Site. At a February 8, 1990 public meeting U.S. EPA presented the Proposed Plan for the site, answered questions and accepted comments from the public.

II. BACKGROUND ON COMMUNITY INVOLVEMENT

The NL\Taracorp Superfund site occupies almost 16 acres at 16th Street and Cleveland Boulevard in Granite City. There are areas near the site that are mostly residential and these areas were found to contain lead levels which could be a health threat to the community. An estimated 55 city blocks could be included in the area to be remediated.

ISSUE # 1: Some of the local officials and homeowners are not convinced that a health threat really exists. There is no current standard set for lead in soil. These local officials and homeowners are questioning the recommendations set by ATSDR and adopted as guidance by U.S. EPA. There is a request for blood lead testing to be conducted on the residents in the site area to determine if any actual health effects exist. The officials and homeowners say this would be a way to determine the course of action.

ISSUE # 2: Local officials and some homeowners are concerned with an adverse impact on economic development and property values. This contingent says that too stringent of a cleanup value is being placed on the site and that this is exaggerating the situation out of proportion.

ISSUE # 3: Some residents living directly adjacent to the site are anxious for U.S. EPA to take action. They say that some officials and property owners are more concerned with economic issues than people's health.

ISSUE # 4: Some residents object to collecting the contaminated material and leaving it in a pile with the already existing pile on site.

ISSUE # 5: As stated in a previous issue, there is no current standard for lead in soil. Potentially Responsible Parties for the site are arguing against the 500 ppm residential cleanup recommendation of U.S. EPA's Proposed Plan, saying hard data backing up this recommendation is lacking.

These issues were identified during a February 8, 1990 public comment meeting and are reflected in the transcript of the meeting. Public comments received orally during the meeting and in writing during the comment period also reflect these issues.

The following categories include the summarized responses to the above issues.

1. GENERAL
2. TECHNICAL
3. HEALTH
4. LEGAL

The comments are paraphrased in order effectively summarize them in this document. The reader is referred to the public meeting transcript and written comments which are available at the public information repository.

General

- G1. A handful of comments received asked that the contaminated areas be cleaned up with no specific reference to an alternative. These comments were supportive of non-specific action and some asked that the residents be kept informed of the process and work progress.

The U.S. Environmental Protectional Agency (U.S. EPA) Region 5, acknowledges the comments and support of action at the site. As the project progresses, U.S. EPA will distribute information to the community through a variety of ways, such as press releases, newspaper advertisements, direct mailings and informational meetings, either formal, or informal, depending on the need. U.S. EPA has established an information repository where documents and information about the site can be found. It is located in the Granite City Public Library, 2001 Delmar Avenue, Granite City, IL.

HEALTH-BASED COMMENTS

EPA has received six public comments on the proposed Record of Decision which address the risk assessment and/or health impact to the residents of Granite City posed by the NL/Taracorp Superfund site at Granite City, Illinois. These comments and the EPA response follows.

H1: We received an extensive comment (49 pages plus exhibits A-D) from NL Industries on the proposed clean-up plan for the NL/Taracorp Superfund site. Their comment is attached to this responsiveness summary. The U.S. EPA response is presented in two sections. The health-based portions of the comments are addressed below, and the technical portions comprise comment T6 on page 10 of this responsiveness summary. In summary, NL Industries maintains that their recommended remedial action, alternative D, fully complies with EPA's interim guidance on establishing soil clean-up levels at Superfund sites, and moreover, that it supports a clean-up of areas with soil lead levels above the 1,000 ppm level as being fully protective of public health. They identify children as the group which has been shown to be the most sensitive to lead. They document their conclusions with a three-prong "risk assessment" approach: a review of the blood lead survey data collected by the Illinois Department of Public Health (IDPH) in April 1983, a risk assessment prepared by O'Brien and Gere Engineers, Inc. using a modification of the outdated Acceptable Daily Intake (ADI) approach, and an abbreviated review of post-1980 literature on lead exposure which they used to identify the slope of the relationship between soil lead and blood lead levels in children.

Secondly, NL Industries refutes the selection of the remedial action alternative H (a clean-up of soil to the 500 ppm level) proposed by EPA and the Illinois Environmental Protection Agency (IEPA) on the following grounds: in support of this clean-up level, EPA used irrelevant vegetable consumption data, the pre-1975 Madhaven et al. study data on lead exposure to derive the relationship between soil/dust lead levels and blood lead levels, the work plan for the Cincinnati Soil Lead Abatement project which has no bearing on Granite City conditions, and Superfund Records of Decision (RODs) prepared for other, dissimilar sites.

U.S. EPA Response: A careful reading of the public comment prepared by NL Industries and of the Risk Assessment prepared by O'Brien and Gere as part of the Remedial Investigation report for the NL/Taracorp Superfund site is necessary to comprehend the concerns presented. It is understandable that NL Industries objects to the 500 ppm lead in soil clean-up level, given the information presented. NL offers three "risk assessments" in defense of their proposed 1,000 ppm soil clean-up level.

The first approach, the use of blood lead survey data collected by IDPH in 1983 to justify a soil lead clean-up level is flawed in many respects: a final report of this survey was never prepared by IDPH and the conclusions reached by the contractors for NL Industries using this data are therefore suspect; the commenters use a combination of elevated blood lead levels and elevated levels of free erythrocyte protoporphyrin (FEP) in blood to delineate an adverse health outcome in children while a literature review indicates that

FEP, which is an indicator of deranged heme synthesis, is a poor indicator of blood lead levels and other adverse health effects; Rabonowitz et al. (Arch. Environ Health 1984) have shown that blood lead levels are not stable and caution against the use of a single measurement to evaluate lead exposures.

The second approach, the risk assessment prepared by the NL Industries' contractors is also flawed. It uses a modification of the outdated Acceptable Daily Intake (ADI) approach, citing the new Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part A), December 1989 and the approval of EPA's Environmental Criteria and Assessment Office (ECAO) as justification for this approach. O'Brien and Gere has misunderstood that toxicity values derived in such a manner must be approved on a case by case basis before being used. The use of the derived modified dose in this risk assessment is erroneous. A major flaw in this risk assessment is that it fails to identify the critical population at risk, the child under the age of six years, and instead presents the chronic risk to the adult population using a lifetime exposure to lead in soil. While the soil lead exposure does continue over a lifetime, the most sensitive endpoint is the subchronic effects seen in developing children. To dilute this effect over a lifetime exposure of 70 years greatly underestimates the risk to children and is completely unacceptable to EPA. If the risk assessment were to be done using the derived toxicity values as applied to the most sensitive population, children under the age of six, a clean-up level below 500 ppm lead in soil would be warranted, as has been demonstrated in risk assessments prepared for other lead smelter sites. EPA rejects this approach in favor of other site-specific approaches presented in Appendix B.

The last approach to justify the soil clean-up alternative D, the use of three of the lowest slope factors abstracted from the literature to derive the relationship between soil lead levels and blood lead levels appears to be a concerted effort to obscure the issue. A literature review quickly shows that a myriad of slope factors for the soil/blood lead relationship have been proposed, ranging from 1.1 to 7.6 micrograms per deciliter blood lead per 1,000 ppm soil lead. In general, the slope factors from mining sites can be shown to average approximately 2.0, which is about half the average slope from smelter sites (the median slope factor is approximately 4.0). The slope relationship, at best, emphasizes correlations. These estimates make no assumptions about exposure, bioavailability, the age range of the population studied, and so on, which makes the derived slope factor relationship tenuous. Ongoing studies supported by EPA are presently underway to further delineate this relationship. Until more conclusive data is available to support a blood/soil lead relationship, EPA rejects a risk assessment approach which relies on slope factors.

In conclusion, the three "risk assessment" approaches proposed by the contractors for NL Industries fail to identify a risk at all to children living in the area of the NL/Taracorp Superfund site, and are fundamentally flawed and unacceptable for use to establish a soil lead clean-up level for the NL/Taracorp site.

The second set of comments address the EPA selection of remedial action alternative H. NL Industries misunderstands the criteria which were used by EPA to determine the need for a 500 ppm lead in soil clean-up level at the NL/Taracorp Superfund site. This goes to the basis for rejecting the 500 ppm soil clean-up level. For a discussion of the factors used to determine the proposed clean-up level, this commentor is referred to the position paper presented in Appendix B. Comment is required on two issues that will not be

addressed in the position paper. The first is the suggestion that the work plan for the Cincinnati Soil Lead Abatement project was used by EPA as support for alternate H. This is totally erroneous as results from the Cincinnati project are not expected to be available until June 1992, long after remediation at the NL/Taracorp site is underway. Data from the Cincinnati project, as well as the Baltimore and Boston projects, have been used to test the Integrated Lead Uptake/Biokinetic Model which is expected to replace the Reference Dose for evaluation of the toxic effects of lead. Secondly, other RODs have not been used to select the clean-up level for the NL/Taracorp Superfund site, although the conditions at several other sites across the country suggest that the use of similar risk assessment methodology would advocate a similar clean-up level. Other RODs have been consulted to demonstrate a trend of more stringent soil lead clean-up levels across the country.

In general, we disagree with the conclusion that the CDC blood lead level of 25 micrograms per deciliter or the proposed 15 micrograms per deciliter can be considered as a threshold effect level for lead. Health effects at the 10-15 micrograms per deciliter level have been well documented in numerous publications by Needleman et al. A report by Schwartz and Otto in 1986 suggests that blood lead levels as low as 5 micrograms per deciliter may be associated with minor hearing problems. EPA does agree with the comment from NL Industries that the incorporation of the Biokinetic Model and other generic and site-specific data into the development of clean-up levels for lead are appropriate.

H2: We received a comment from the Tri-Cities Area Chamber of Commerce stressing that the issue of what the proper clean-up level at the NL/Taracorp Superfund site must be resolved. They maintain that only a site-specific risk assessment can properly address this question. They have requested that only areas that have been proven to pose a health hazard be cleaned-up, and that the clean-up begin at once and be completed as soon as possible.

U.S. EPA Response: EPA agrees that the clean-up level for lead at Superfund sites should be carefully chosen and suggests a range of values (from 500 to 1,000 ppm lead in soil), with the choice within that range to be dictated by the site-specific characteristics of the site (OSWER Directive # 9355.4-02). Traditional risk assessments have been difficult to carry out for sites containing lead as a contaminant due to the inability to determine a safe level for lead in soil under all conditions. Where risk assessments have been used for this purpose, the calculations are sometimes suspect and have resulted in soil clean-up levels down to 200-250 ppm lead in soil in some cases. EPA used site-specific considerations in the setting of the 500 ppm soil clean-up level at the NL/Taracorp site. However, EPA believes that a better approach for determining the proper clean-up level at Superfund sites is through the use of models, which are discussed in the position paper in Appendix B. The use of a favored model, the Lead Uptake/Biokinetic Model, demonstrates that approximately 34% of the Granite City children under the age of six will have blood lead levels greater than 15 micrograms per deciliter if the 1,000 ppm clean-up level for lead in soil is allowed. This would put 34% of the children above a level that may represent a risk of adverse health effects.

H3: We received one comment from a Granite City resident who is extremely concerned over the health hazards presented by the lead in the soil in the Granite City, Madison and Venice area. He has made an effort to read the material deposited by the EPA in the reading file and has consulted with four professors at major universities regarding the problem. He accepts that recent studies show a multitude of adverse health effects in children associated with blood lead levels greater than 10 micrograms per deciliter. He is aware that the clean-up proposed by the EPA is not aimed at reducing soil lead levels to those thought to be necessary to reduce the blood lead levels of children below 10 micrograms per deciliter, and he questions whether the EPA proposed clean-up will be fully protective or leave large numbers of children at risk to lead poisoning. He urges EPA to begin an immediate testing of all locations in the area where children play and inform parents as to the dangers that exist there.

U.S. EPA Response: This resident has also learned of a report being prepared by the Society for Environmental Geochemistry and Health (SEGH) Task Force on Lead in Soil and believes that the report to be released this summer will give further input on this problem. He requests that EPA refrain from making a decision on the soil clean-up level until that report is released.

At present, the National Centers for Disease Control (CDC) has determined that blood lead levels equal to or greater than 25 micrograms per deciliter represent a reason for concern. CDC is now considering a level of 15 micrograms per deciliter to protect for the health effects seen at lower blood lead levels. EPA has also adopted this "action level" for the purpose of the clean-up at Granite City because the significance of changes seen in children at blood lead levels below 15 micrograms per deciliter are not yet understood. The EPA is the funding agency for the SEGH Task Force on Lead in Soil, whose report will probably be made public at the SEGH Meetings to be held in Cincinnati in July. However, the study by the SEGH Task Force is just one of many efforts currently underway to delineate the impact of lead in various media on the health of young children. The SEGH Task Force on Lead has recommended the use of a lead soil matrix formula, which will allow a variety of environmental factors to be considered in the development of a site-specific evaluation of lead hazards. Another tool, the Lead Uptake/Biokinetic Model, is also under evaluation and is expected to be released to the EPA Regions in April 1990. The Biokinetic Model is expected to fill the deficit caused by the withdrawal of a reference dose to assess the health effects of lead. The model is more fully described in the position paper on lead presented in Appendix B. When site-specific data collected in Granite City and a soil lead level of 500 ppm is input into the Biokinetic Model, a mean blood lead level of 8.37 micrograms per deciliter is predicted, with approximately 8.5 percent of the children predicted to attain blood lead levels greater than 15 micrograms per deciliter. EPA believes that the clean-up level of 500 ppm lead in soil is appropriate because further reductions in food lead levels are anticipated due to the removal of lead-containing soils and to the reductions in allowable releases of lead to the air and in the water expected from changes to the National Ambient Air Quality Standard and the National Primary Drinking Water Regulations later this year.

H4: We also received a comment from Bobby G. Wixson, Dean of the College of Sciences, Clemson University, South Carolina; He is one of the professors

solicited by the above Granite City resident and the Chairman of the SEGH Task Force on Lead in Soil. He stressed that the task force remains convinced that a matrix approach to a site-specific location and population at risk be used rather than a single number or abatement approach applied to all sites, and he provided a copy of the May 1989 presentation on the status of the SEGH Task Force in which the matrix approach was presented. He voiced a concern that Region V not adopt a 500 ppm lead in soil level as an interim guideline without knowledge of the target blood lead soil matrix model. He advised that the clean-up level might actually be higher or lower than 500 ppm if based on the health criteria used to derive the SEGH model.

U.S.EPA Response: While the Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites (OSWER Directive # 9355.4-02) sets forth an interim soil clean-up guideline for total lead in soil at 500 to 1,000 ppm, it also allows that "site-specific conditions may warrant the use of soil clean-up levels below the 500 ppm level or somewhat above the 1000 ppm level". This latter clause has recently been used to set a residential soil clean-up level at 250 ppm in another region. The use of the SEGH Task Force matrix model is one method for achieving a site-specific guidance level for clean-up. However, recent and frequent conversations with the EPA Office of Research and Development concerning this matter indicate that the model favored by that office is the Lead Uptake/Biokinetic Model, which has already been largely validated. When site-specific data from the NL/Taracorp Superfund site are used in that model, a cut-off soil lead level of 500 ppm can be shown to be appropriate for the Granite City site clean-up. Actual parameter values used in the model can be found in Appendix B.

H5: We received one comment from a Granite City resident who had chronicled a history of multiple deaths due to cancer and heart disease in her family and in her husband's family. She expressed a concern that this history of disease was directly tied to the lead and other foreign particles in the air and in the ground in the area. She believes that "there is a clear and present danger" due to the lead in the soil and urges that the EPA clean-up project begin immediately.

U.S. EPA Response: This resident's concern that this history of family illness is related to the lead and other foreign chemicals in the air and in the ground is probably warranted. One of the primary concerns of the EPA is that residents of highly industrialized areas are exposed to a complex mixture of toxic chemicals, which can enter their bodies from the air, water, contact with soil and food products. In addition, personal habits such as smoking and over-eating, genetic factors, and exposures received in the workplace further predispose the body to diseases such as cancer. With so many factors operating to cause some types of cancer, it is difficult to trace any particular incidence of cancer in this resident's family to a single cause without careful documentation. However, the concentration of toxic pollutants in the air, water and soil have sometimes reached very high levels in the past. The EPA has strived in recent years to reduce the levels of such pollutants and their related health effects. In Granite City, we will continue to pursue whatever clean-up is necessary to reduce the danger to these residents from exposure to lead in the soil, and we will make every effort to move forward with this clean-up with expediency.

H6: We received a comment from the Illinois Department of Public Health, which offered four points for consideration. Their primary concern is that they have been told that a risk assessment could not be performed at the NL/Taracorp Superfund site because an EPA verified Reference Dose for lead is unavailable, and they object to that premise. Secondly, they question the use of a generic clean-up level in the range of 500-1,000 ppm lead in soil, arguing that this is a CDC generated level and CDC itself has often not recommended soil removal until the lead level reaches levels as high as 5,000 ppm. They argue that the use of a generic clean-up level sets a dangerous precedent which allows IDPH to propose multiple other sites in the area for inclusion on the Superfund list. They go on to suggest that biomonitoring of the population in the form of repeated blood lead level testing of area children, testing of domestic animals (dogs and cats) residing in the area, and such could be used to resolve the issues of risk assessment and clean-up objectives, and they urge that a carefully designed and implemented biomonitoring program be instituted in Granite City. Their final comment addresses the perceived need for an educational effort to answer questions raised by citizens and urges that an integrated joint effort between agencies be used to answer citizen concerns.

U.S. EPA Response: The concern that a traditional Superfund structured risk assessment cannot be prepared for the NL/Taracorp site has already been discussed in the response to the comments from NL Industries (H1) and the Tri-Cities Chamber of Commerce (H2). Region V agrees with the rationale that a generic clean-up level should not be used at any Superfund site, and that site-specific factors such as populations at risk, bioavailability, etc. should be considered in setting such clean-up levels. The comments and responses presented in H3-H5 and in Appendix B suggest the approach that EPA believes is reasonable to address this concern. EPA strongly disagrees with the premise that the clean-up at hazardous waste sites should be limited because such a clean-up may set a precedent for the potential clean-up of other areas which have become contaminated through other routes. EPA recognizes that there may be other lead contamination problems in Illinois, and encourages that other such sites be identified and assessed for inclusion on the NPL. This, however, is not a comment that is specific to the NL/Taracorp site. Clean-up levels below 500 ppm have been accepted at other sites. In response to the third comment set forth by IDPH, EPA is not adverse to the biomonitoring of sensitive populations exposed to soil lead in the Granite City area and suggests that women of child-bearing age as well as children under the age of six be especially targeted for a biomonitoring program. A blood lead study has been added to the selected remedy in response to public comments. However, EPA believes that the soil lead levels at the NL/Taracorp site represent an present and on-going hazard to these segments of the population and is reluctant to postpone any remedial activities in favor of a data-gathering endeavor. IDPH's suggestion that an educational effort is needed to address citizen concerns is a good one. EPA has already delivered, door-to-door, one Lead Guidance Fact Sheet to residents in the area and has begun the preparation of more complete guidance to be distributed before the summer season when children face the greatest exposure to lead in soil. EPA would welcome input for inclusion in this latest flyer. By distributing this information early, EPA hopes to keep soil ingestion and thus, blood lead levels at a minimum during the period required for further soil sampling and the development of the soil removal activities.

Technical

- T1. Two commenters sent U.S. EPA information regarding the locations of other areas around the site where battery case material potentially came to be located.

U.S. EPA Response: U.S. EPA thanks these commenters for providing very useful information. Appropriate follow-up will be taken in these areas.

- T2. One commenter requested that material submitted to U.S. EPA be included in the Administrative Record for the site.

U.S. EPA Response: The material was placed in the Administrative Record for the NL Site, and where appropriate, background information regarding Trust 454 was corrected, as stated in the material submitted.

- T3. Four commenters stated that Alternative A (No Action) is the only alternative having any merit and that further studies are needed before any action is taken.

U.S. EPA Response: Alternative A-No Action is inappropriate due to the fact that waste materials and soils which may pose a risk to human health and the environment would be left in place without any treatment and that it does not comply with all applicable federal and state laws. U.S. EPA feels that a cleanup level of 500 parts per million (ppm) will be protective of the public health in the area of the NL site. Lead levels in residential areas, the Taracorp pile, and St. Louis Lead Recyclers piles range from 1% to 30%, which is 10,000 ppm to 300,000 ppm lead. It is unacceptable to take no action when people may be exposed directly to lead concentrations of this magnitude. Additionally, allowing the Taracorp pile and St. Louis Lead Recyclers (SLIR) pile, both of which contain characteristic hazardous waste, to remain uncovered is not in compliance with the Resource Conservation and Recovery Act (RCRA). It is not necessary to conduct further studies before a remedial action is selected for this site. Data gathered during the Remedial Investigation are sufficient to indicate that a lead contamination problem exists at and around the NL site, and available guidance and national and site-specific lead data are sufficient to select a residential lead cleanup level for the site. However, further studies, including a blood lead study and extensive soil sampling will be undertaken during the design of the selected remedial action to provide residents with current blood-lead information and to determine exactly which areas must be excavated and to what depth.

- T4. One commenter supported the selection of Alternative H and questioned whether residents would be made aware of the results of soil sampling conducted on their properties.

U.S. EPA Response: U.S. EPA acknowledges and appreciates the support for Alternative H. The selected remedy is Alternative H, with five elements added as listed in response to comment T9. Results of soil sampling to be conducted as part of the selected remedy will be made available to the specific residents as well as the community at large.

T5. Three commenters recommended that Alternative G be selected to remediate the NL Site.

U.S. EPA Response: There are advantages to Alternative G, namely the complete removal of all contaminated areas from the Granite City area, which also would remove the vast majority of waste materials which could contribute to future groundwater contamination in the area. However, these advantages are outweighed by the potential for adverse short term health impacts and the increased cost of Alternative G. Due to the nature and wettability of waste materials in the Taracorp pile and SLIR piles, excavation of these piles will generate lead contaminated airborne dust which may create an adverse impact to public health. Although dust suppression techniques can be used to minimize emissions, it is not expected that these techniques will be fully successful in preventing releases to the air from these piles, which are contaminated with up to 30%, or 300,000 ppm, lead. Additionally, transportation of contaminated materials to the nearest RCRA-compliant hazardous waste landfill (which is several hundred miles away) creates the potential for transportation accidents and further releases of dust to the air. The recycling effort included in Alternative G involves manual separation steps which would expose workers to lead contamination. Lastly, the cost of Alternative G is between two and three times that of Alternative H. Ultimately, although Alternative G removes the waste materials from the Granite City Area, the wastes must still be managed at the facility in which they would be deposited. This facility would have a bottom liner and leachate collection system, which would not be provided under the entire expanded Taracorp pile. However, the selected remedy, includes the requirement for a Contingency Plan which would provide for cleanup action if the groundwater becomes contaminated in the future. Therefore, U.S. EPA feels that the selected remedy will provide the same degree of actual protection as Alternative G, and so, is the most cost effective alternative.

T6. One commenter submitted an extensive set of technical comments regarding the Feasibility Study (FS), FS Addendum, and Proposed Plan, which are attached at the end of this Responsiveness Summary. Another commenter incorporated these comments into their own comment.

U.S. EPA Response: (Refer to attachment to this Responsive Summary)

T6a. Paragraph IV. D. of the comment letter is entitled "EPA's Reliance on the Records of Decision to Select A Cleanup Level for the Taracorp Site Contravenes the Interim Guidance and is Scientifically Inappropriate".

U.S. EPA did not rely solely on other Records of Decision (RODs) in selecting a 500 ppm cleanup level for the NL Site. Site specific considerations, studies, and data were used in the selection process; however, as stated earlier in this response, other RODs were useful from the standpoint of

indicating a recent national trend toward more stringent soil lead cleanup levels. The commenter is correct in stating that each site for which a ROD was reviewed has a unique set of conditions and that a direct comparison of these sites to the NL Site was not possible.

T6b. Section V of the comment letter is entitled "Alternative H is neither Cost Effective Nor Technically Feasible". Paragraph A comments on the cost estimate.

The commenter is correct in stating that U.S. EPA's \$25 million estimated cost was not prepared by O'Brien & Gere, NL's consultant, and that U.S. EPA's calculations scaled up the costs developed by O'Brien & Gere for Alternative D. The commenter also states that a 20% deviation in costs during the FS is within the expected range of uncertainty in FS estimates. U.S. EPA agrees with this statement and acknowledges the efforts of the commenter in providing a cost estimate of \$30 million. It is possible that this is a more accurate estimate than \$25 million; however, it must be pointed out that many assumptions, some of which are very conservative (e.g. 100% acquisition of access) are used to generate cost estimates. A more accurate cost will be provided during Remedial Design for the NL Site, when actual numbers based on sampling results and access agreements will be available for variables which are only assumed or estimated at this point. U.S. EPA stands by its estimate of \$25 million for Alternative H at this stage of the project. Elements added to Alternative H as result of public comment have not been costed; however, it is anticipated that, other than contingency measures (see response to comment T9), which will not exceed \$10 million, these additional measures will not exceed \$3.8 million.

T6c. Paragraph B of Section V comments on the implementation time for Alternative H.

U.S. EPA acknowledges the efforts of the commenter in providing an estimate of seven years for implementation of Alternative H. U.S. EPA did not include the period required for Remedial Design in its estimate of 1 1/2 - 2 1/2 years for implementation of Alternative H; this accounts for a discrepancy of one year between the two estimates. U.S. EPA estimated approximately 112,000 cubic yards of soil to be excavate, which is 70% of the 160,000 cubic yards estimated by the commenter; this accounts for a discrepancy of approximately 1 1/2 additional years between the two estimates. U.S. EPA did not add in the excavations of Venice and Eagle Park Acres as an additional time period; it was felt that these excavations could occur concurrently with those in Granite City and Madison. This accounts for an additional discrepancy of approximately 1/2 year. Subtracting the above mentioned discrepancies for the commenter's time estimate yields a resultant estimate of four years.

The remaining discrepancy between the two estimates stems from the estimate of the number of crews that can reasonably work on the project at any given time without creating traffic problems, etc. This is a judgment call, and U.S. EPA felt that more crews could work at any given time than did the commenter. As a result of this comment and additional review of the situation, U.S. EPA has changed its estimate to 2 1/2 years, eliminating the

range of time (1 1/2 - 2 1/2 years) presented in the Proposed Plan. The elements added to Alternative H as a result of public comments will not change this time estimate for construction.

T6d. Paragraph C of Section V comments on the technical infeasibility of implementing Alternative H.

As part of the selected remedy, additional property must be acquired, or the material must be disposed of off-site. Trust 454 property is better suited for the expanded Taracorp Pile since only a small portion of Trust 454 that would be needed for the pile would be at the outer edge of the 100 year flood plain. The affected area on Trust 454 is not in the "floodway", so no additional permits would be required; it is, however, at the very edge of the portion of the 100 year flood plain which is marked as "minimal flooding". From the map, it appears that during a 100-year flood event the water would come right up to the edge of the expanded Taracorp pile, as it would to the existing Taracorp pile and the SLIR piles. If necessary, barriers could be built around the south and west sides of the expanded pile; however, even without barriers it does not appear that a 100 year flood event would harm the integrity of the cap or result in any threat of releases into the environment.

The Commenter is correct in stating that the soil lead sampling done to date is not sufficient to delineate all areas around the site requiring remediation. Additional sampling will be performed during Remedial Design to provide this information. The figure identifying areas 4 through 8 in the Proposed Plan represents only a best estimate of areas requiring remediation based on data gathered to date.

T6e. Section V is entitled "Alternative H's Increased Risk to Residents and Adverse Impacts on the Community and the Environment Are Not Justified by the Minimal Protection it Provides."

U.S. EPA disagrees with this statement and the conclusions drawn in this section, with the exception that truck traffic involved in implementing Alternative H increases the risk of traffic accidents, as compared to implementing Alternative D. U.S. EPA has analyzed the short-term impacts involved with implementing Alternative H (i.e. removing approximately 112,000 cubic yards of contaminated soils from an estimated 58 city blocks) as part of the analysis of the nine criteria. Proper wetting of soils and construction and transportation procedures can be employed such that visible dust emissions will be prevented and adverse impact to the community will be minimal. The technology, equipment, and procedures exist to do this effectively. U.S. EPA recognizes the short-term impacts involved in implementing Alternative H and feels that the benefits resulting from the removal of soil contaminated with lead above 500 ppm outweighs these potential impacts. U.S. EPA also feels that implementing Alternative D is inappropriate since Alternative D allows large quantities of lead contaminated soil with concentrations above that which may cause an adverse public health impact (i.e. above 500 ppm) to remain in place. The elements added to Alternative H as a result of public comments will not significantly impact the above response. Only the potential additional excavation in Venice, Eagle Park Acres, and other nearby communities will increase truck traffic, however, this increase is estimated to be minimal.

- T7. One commenter was concerned about future blood lead testing and past IDPH blood lead testing, emissions during construction, the length of time it took to get information to the public about the contamination problem at the site, and further soil testing prior to excavations.

U.S. EPA Response: The results of soil lead testing were released to area residents in 1988, prior to the release of the RI Report. The RI Report was released in early 1989. An availability session was held in October 1988 to discuss the results of soil lead testing with residents. Although several local politicians attended, no residents came. During this public comment period U.S. EPA discovered that using the local newspaper and other media does not effectively disseminate information in the affected communities around the NL/Taracorp Site. Information was provided effectively by handing out fact sheets door-to-door, and this practice will continue in the future. So, although the information provided in January 1990 may seem relatively new, U.S. EPA has been providing information through the media as it has become available.

U.S. EPA cannot provide a response for the Illinois Department of Public Health (IDPH) regarding its conduct of a blood lead study in 1982; however, in response to public comments received, U.S. EPA has added the requirement for a blood lead study to the selected remedy. The study will be performed by or in consultation with IDPH during the summer of 1990 and will be designed to provide current information on potential health effects associated with site contamination. Blood lead testing is the most effective means available to determine whether acute effects due to lead contamination may exist in the community.

Dust control measures included in the selected remedy will be implemented during construction activities. These measures, which will primarily consist of applying water to soil to be excavated, will be employed to prevent visible emissions of dust and will minimize any adverse health effects arising during construction.

Regarding additional soil sampling, the selected remedy includes extensive sampling of each yard in the suspected zone of contamination and all applicable alleys, driveways, and yards in Venice and Eagle Park Acres to determine exactly which areas must be excavated and the extent of excavation. This will be performed before excavation begins.

- T8. One Commenter expressed support for Alternative H and asked if any or all houses will be demolished as part of the selected remedy.

U.S. EPA Response: U.S. EPA acknowledges and appreciates the support for Alternative H. No demolition of houses will be performed as part of Alternative H, the selected remedy.

- T9. Three commenters expressed concern over the negative economic impact the selected remedy will have on the surrounding areas, including problems with the resale of property in the zone which has been labelled "contaminated".

U.S. EPA Response: U.S. EPA can understand the concern citizens have for the resale value of property in the "contaminated zone," as well as the economic impact the selected remedy could have on the surrounding areas. The U.S. EPA must, however, consider risks to human health and the environment from the contamination to be our top priority in addressing this Superfund Site.

Bear in mind that the contamination exists no matter what remedy is selected; it is, in fact, the contamination, not the cleanup, that is the true culprit in terms of any real or perceived stigma resulting in lowered property values or negative economic impacts. The selected remedy will result in a cleaner, healthier living environment in the affected areas, particularly in light of the fact that there will not be a continuing source of airborne contamination, and the residential properties will be left with the same or better appearance than they currently have. This should ultimately result in increased property values. Although the Taracorp pile will remain in place and be expanded, after the cap is completed, it will be less of an eyesore and less of a threat to human health and the environment than it has been all the years it has been part of the Granite City landscape.

T10. Two commenters expressed concern about whether public comments would have any bearing on U.S. EPA's final decision on the selected remedy.

U.S. EPA Response: U.S. EPA appreciates the comments it has received regarding its Proposed Plan for cleanup of the NL/Taracorp Site. Five elements have been added to Alternative H as a result of public comments (Alternative H, as amended by the addition of these five elements, is U.S. EPA's selected remedy):

1. Blood lead sampling to provide the community with current data on potential acute health effects associated with site contamination, to be conducted in summer, 1990,
2. Inspection of the interiors of homes on property to be excavated, to identify possible additional sources of lead exposure and recommend appropriate actions to minimize exposure,
3. Inspection and remediation of additional areas of contamination in Eagle Park Acres, Venice, Granite City, and Madison which were not identified in the draft FS Report, and
4. Development of contingency measures to provide for sampling and proper disposal of any soils within the zone of contamination with lead concentrations above 500 ppm which are presently capped by asphalt or other barriers but become exposed in the future due to land use changes or deterioration of the existing use.
5. Construction of a bottom clay liner under newly constructed portions of the expanded Taracorp pile.

T11. One commenter listed a series of questions which are answered below.

- Q. What level of lead is in site area #8 and how much direct contact would it take to become dangerous to my health?

R: The lead levels in site area #8 range from just over 500 ppm to approximately 2500 ppm. It is not possible to determine how much direct contact it would take to become dangerous to the commenter's health. Each individual has a different reaction to lead exposure. U.S. EPA has selected the 500 ppm cleanup level to be protective of sensitive individuals.

Q: Can I send a sample of my yard and have it tested?

R: Each yard which may require cleanup will be tested to determine the depth of excavation required. This test is anticipated to begin in early 1991, so the commenter's yard will be tested then. It may be possible to arrange for some limited testing prior to that time for persons who want to have information prior to 1991; however, nothing has been planned at this time.

Q: Would the residents be allowed to stay in their homes during construction?

R: Yes

Q: Would U.S. EPA have to tear up fences to remove the soil?

R: No, shovels would be used for excavating tight spots, such as fences and along driveways and foundations.

Q: Would trees be damaged by this soil removal?

R: We do not expect any trees to be damaged; however, some shallow roots may be slightly damaged. The excavation would be implemented in a manner to minimize potential damage.

Q: After work completion, would realtors have to mention anything to potential buyers in the area?

R: Yes, under the Illinois property transfer laws, the prior contamination of the property will be documented; however, the cleanup will be also be documented, and this will indicate to potential buyers that the property has been cleaned up to levels which are considered protective of public health.

Q: When would the work start?

R: It is projected that actual excavation activities would begin in later 1991 or early 1992.

T12. One commenter expressed criticism of Alternative H.

U.S. EPA Response: No response is really necessary since no reasons for the criticism were outlined. U.S. EPA appreciates the comment.

T13. One commenter stated that an independent firm should conduct testing to determine the scope of soil contamination before any more hysteria is created without facts.

U.S. EPA response: Testing conducted to date clearly indicated that there is a soil lead contamination problem at and around the NL/Taracorp Site. Further soil testing will be required to determine which yards must be excavated and to what depth. U.S. EPA regrets any hysteria that may have been created during the remedy selection process. Throughout the process, U.S. EPA has clearly stated that the situation at the NL site is not an emergency situation but that cleanup is required to prevent potential chronic health effects that may arise from exposure to contamination at and around the site.

T14. One commenter supported Alternative D, proposed that residence located within the 1000+ ppm zone be purchased, razed, excavated, and that the areas be rezoned as commercial; stated that work should commence as soon as possible; and supported the conduct of a blood lead study prior to the commencement of any work at the site. Another commenter supported Alternative D and submitted a petition with approximately 300 signatures.

U.S. EPA Response: Alternative D is not acceptable because soils and battery case materials containing lead concentrations above levels which may present a risk to public health are allowed to remain in place under Alternative D. This is not an acceptable situation.

Razing and excavating homes is not appropriate. The area can be cleaned up to levels which will be protective of the public health without creating such a major disruption to the residents who live there and without such a high cost. The idea of rezoning certain areas as commercial is interesting but is not within the realm of U.S. EPA's authority, and problems exist with this due to potential disruption of residents who presently live there and the fact that the areas will be cleaned up to protective levels under the selected remedy, making rezoning potentially moot.

U.S. EPA will expend every effort to commence work as soon as possible.

A blood lead study has been added to Alternative H as part of the selected remedy; however, setting soil lead cleanup standards from a blood lead study is not appropriate, for reasons outlined in the response to Comment H1.

Sufficient data have been collected to date to select a cleanup level for lead for this site, and postponing remedy selection for further studies contradicts the above-stated desire to commence work as soon as possible.

T15. One commenter supported a site-specific, risk-based approach for selecting a cleanup level and supported capping of contaminated areas (Alternative B) as opposed to removal of soils.

U.S. EPA Response: To the extent possible, U.S. EPA used a site-specific risk-based approach in selecting the 500 ppm cleanup level for the NL Site. A complete, quantitative risk assessment could not be performed for reasons outlined in the response to comment H1. Given this fact, U.S. EPA used applicable guidance, available data, and site-specific factors, such as the form of lead deposition present, the type of community, and the fact that

residential areas are present around the site, to select the 500 ppm cleanup level.

Capping, as outlined in Alternative B, is not appropriate for residential areas around the site because soil with lead concentrations above levels which may present a risk to public health are allowed to remain in place and can easily become exposed in the future due to gardening, excavation, etc. It is impossible to ensure the integrity of the cap in each residential yard, and removal of the contaminated soil is more protective and appropriate. Capping will also raise the elevation of all capped areas, which may present runoff/erosion problems. Along with monitoring and institutional controls, capping is appropriate for remediation of the expanded Taracorp pile and included in the selected remedy for that reason.

T16. One commenter stated that: 1) all actions on the NL site cleanup proposals be put on hold until blood lead testing is conducted on residents in the designated areas, 2) U.S. EPA has caused severe economic problems for landowners and the City of Granite City, Illinois through inadequate studies and their subsequent release to the public, and 3) the IDPH blood lead study of 1982 did not indicate elevated blood levels in the residents tested.

U.S. EPA Response: Statements 1) and 2) of this comment have been addressed in the response to comments T14 and T9, respectively. The IDPH blood lead study of 1982 did indicate elevated levels in the residents tested and, by the present standards used by toxicologists to evaluate health risks, indicated that some of the residents tested had blood lead levels which would present a health risk. U.S. EPA has questioned the usefulness of the IDPH study.

L1. Comment: Several questions were raised concerning the impact of the clean up on A & K Railroad. The railroad is located near the Site. The commenter believes alternative H should be chosen, with modifications to include industrial areas such as A & K Railroad. The commenter asks (1) who is liable for contamination placed on a site before its present ownership, (2) whether U.S. EPA has jurisdiction over industrial areas located within a Superfund Site, (3) what government agency regulates the health and safety of a company's employees, and (4) what federal government agency should address concerns about toxic levels in the soil, water, and air found at an industrial plant site.

Response: The scope of liable persons under the Superfund law is discussed at 42 U.S.C. §9607(a) (CERCLA §107(a)). Persons liable include but are not limited to the present owner of a facility, the owner or operator of a facility at the time of disposal of a hazardous substance, any person who arranges for the disposal or treatment of hazardous substances owned or possessed by such person, and any person who accepts hazardous substances for transport to disposal or treatment facilities. CERCLA Section 107(b) lists three exceptions to the scope of liability discussed in Section 107(a). The exceptions include (1) an act of God, (2) an act of war, and (3) acts or omissions of a third party. The third defense, however, requires that due care was taken by the party using the defense with respect to the hazardous substance concerned. The party using this defense must have also taken precautions against foreseeable acts or omissions of any such third party and the foreseeable consequences from such acts or omissions.

A Superfund site may include any area, industrial or otherwise where a hazardous substance has been deposited, stored, disposed of, placed, or otherwise come to be located. 42 U.S.C. §9606 (CERCLA §106) grants authority to the Attorney General of the United States to secure such relief as may be necessary to abate the danger of an actual or threatened release of a hazardous substance from a Superfund site.

The Department of Labor is the federal government department which regulates the health and safety of employees. The U.S. EPA, in cooperation with the State Environmental Protection Agency, is the federal agency which addresses concerns about toxic levels of substances in the soil, water and air.

L2. Comment: One commenter challenged both U.S. EPA's selection of alternative H as the appropriate remedy and also U.S. EPA's selection process. The commenter raised concerns that the remedy will cost more than U.S. EPA initially estimated, the remedy will require additional property to dispose of residential soils, short term dangers of choosing alternative H may outweigh the

advantages of alternative D and were not properly considered, and the potential disruption of the community was not properly evaluated by U.S. EPA. The commenter estimates the cleanup may cost \$40 million. The estimate is based on the belief that U.S. EPA underestimated the need for either the purchase of additional property or off site disposal of wastes.

Concerns were also raised regarding U.S. EPA's selection process. The commenter believes U.S. EPA did not properly notify affected parties of the public comment period and U.S. EPA's increased cost estimates for the site, relied on general guidance to determine cleanup levels rather than site specific information, and has failed to offer a better alternative to the risk assessment conducted during the remedial investigation by NL Industries which was rejected by U.S. EPA. The commenter recommends a new, binding risk assessment, raises the possibility of conducting blood lead studies in the affected area, and requests an extended public comment period to evaluate revised proposals.

Response: The commenter's concerns regarding the additional public benefits of choosing alternative H over other alternatives and the cost estimates for alternative H are addressed in response to comment T6.

Affected parties have been properly notified of U.S. EPA's actions throughout the remedy selection process. On December 18, 1989, U.S. EPA conducted an informational meeting to inform potentially responsible parties of available site information. All identified PRPs were notified of the meeting. Information discussed at the meeting included the proposed cleanup standards being considered by U.S. EPA. The meeting informed the PRPs of where U.S. EPA was in the selection process and gave all parties an anticipated time frame for the public comment period, a public meeting to be held in Granite City, Illinois, and the scheduled date for this Record of Decision. Public notice was subsequently given for both the public comment period and the public meeting held in Granite City. U.S. EPA agreed to meet with all parties who requested meetings with U.S. EPA during the selection process. In addition, four availability sessions were conducted in Granite City to further inform the public about the site and respond to any concerns. U.S. EPA extended the final date of the public comment period from February 24, 1990, to March 12, 1990, in response to the strong public interest in the site. The extension was made without any formal requests for an extended public comment. Little interest has been shown for an additional extension to the public comment period. U.S. EPA does not believe an additional extension is appropriate at this time.

U.S. EPA revised its cost estimate for site cleanup after release of the proposed plan for the site. An addendum was added to the proposed plan with an updated cost estimate. The addendum was placed with the proposed plan in the public repository for site documents and was sent with the proposed plan in all freedom of

information request responses. U.S. EPA has shared its revised cost estimates as soon as they were available with all parties. The revised cost estimates were given at the public meeting in Granite City, in meetings with local officials, at availability sessions in Granite City, and were reported in the press. Cost estimates were also shared in numerous phone calls both before and after the public meeting.

The commenter's recommendation for a blood lead study has been incorporated into this Record of Decision. However, a second risk assessment would not add additional, useful information to the remedy selection process for the same reasons U.S. EPA rejected the initial risk assessment. The validity of a risk assessment depends on the reference dose used to evaluate risk. At this time, the selection of any reference dose would be arbitrary for the reasons discussed in Appendix B.

Attachment

PUBLIC COMMENTS OF NL INDUSTRIES ON THE PROPOSED PLAN FOR THE TARACORP SUPERFUND SITE, GRANITE CITY, ILLINOIS

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I. INTRODUCTION

NL Industries (NL) submits these comments for the public record for the Taracorp Site, Granite City, Illinois in support of the implementation of Remedial Alternative D. For the reasons set forth in this public comment, Alternative D is the most cost-effective remedy which will protect human health and the environment in accordance with CERCLA. NL will demonstrate that EPA's selection of recommended Remedial Alternative H violates EPA Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund sites and ignores site specific data and risk assessments which support the implementation of the 1,000 ppm clean-up level proposed in Alternative D. Furthermore, it is not justified by available scientific studies relevant to lead exposure and is technically infeasible. Finally, implementation of Alternative H will disrupt the Granite City community, and expose it to unnecessary adverse health, safety and environmental impacts.

Alternative H involves the removal and resodding of lead-bearing soils from a ninety-seven block area in Granite City, one of the largest projects undertaken by the Superfund program. Supporting technical and scientific data for this incredible proposal were not developed during the five-year remedial investigation/feasibility study conducted by NL with IEPA and EPA oversight. Instead, they were released less than two months ago, without review by the Illinois Department of Health or O'Brien & Gere, the engineering firm approved by EPA

and IEPA to investigate the site and propose selected remedial alternatives.

The essential difference between Alternative H and NL's preferred Alternative D is the clean up level for lead-in-soil in residential areas. In general, Alternative H would clean up residential areas with soil lead above 500 ppm, while Alternative D cleans up areas with soil lead above 1,000 ppm. As these comments will demonstrate, the 1,000 ppm level proposed by NL is not only supported by EPA guidance and site specific risk assessment data, it will be fully protective of public health, particularly the health of children, who as a group have been shown to be more sensitive to lead.

Alternative D fully complies with EPA's Interim Guidance on Establishing Soil Lead Clean-up Levels at Superfund sites by employing three valid risk assessment approaches, including a site specific local blood lead study, a modified ADI approach for lead and a soil/blood lead correlation incorporating recent data on lead exposure. In contrast, EPA's Alternative H does not rely on site specific data, but instead on limited vegetable uptake studies irrelevant to Granite City conditions and outdated information on lead exposures. Moreover, the cost and implementation time of Alternative H has been underestimated by EPA and community impacts and technical feasibility concerns have been ignored. EPA's recommendation of Alternative H and arbitrary and capricious rejection of Alternative D without scientific or technical justification

violates the letter and spirit of CERCLA, wasting precious Superfund monies with no additional benefit to the public or environment.

II. THE BACKGROUND AND HISTORY OF NL'S CONDUCT OF THE RI/FS AND PROPOSED REMEDIAL ALTERNATIVE.

NL voluntarily entered into an Administrative Consent Order ("ACO") for conduct of a remedial investigation feasibility study (RI/FS) with EPA and the Illinois Environmental Protection Agency (IEPA) in May, 1985. The ACO scope of work negotiated and agreed to by the parties required NL to undertake a site-specific risk assessment, incorporating previous sampling, blood tests and health studies undertaken at the site.¹

During the next five years, NL fully complied with the terms of the order, conducting three separate site-specific risk assessments, supervised by U.S. EPA and subjected to peer

¹ The ACO also required compliance with the EPA Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA. This Guidance provides that:

- a. the RI must be tailored to meet site-specific needs;
- b. data generated must be evaluated in context of individual nature of the site; and
- c. where ARAR's are unavailable, toxicity assessment should be based on reference doses. The weight of the evidence associated with toxicity information is a key element of this risk characterization.

review scrutiny. NL submitted the preliminary feasibility study report in August, 1989. It concluded that a 1510 ppm soil lead level for residential areas was protective of public health and the environment and conservatively used a 1,000 ppm soil lead level to select residential neighborhoods targeted for remediation.

NL received comments from U.S. EPA and IEPA on October 4, 1989, arbitrarily rejecting the previously approved and legally required risk-based approach to remediation of the site. The agencies instead proposed a 500 ppm level for residential soils and a 1,000 ppm level for industrial areas based on their interpretation of U.S. EPA Interim Guidance on Establishing Soil Lead Clean-up Levels at Superfund Sites issued in September, 1989. NL responded to these comments in compliance with the Consent Order on November 10, 1989, but U.S. EPA, without explanation, has refused to enter into dispute resolution to resolve the differences in the two approaches, in direct contravention of Paragraph 17 of the Consent Order.²

On January 10, 1990 U.S. EPA further breached the Consent Order by releasing NL's August, 1989 study, with an

² Paragraph 17 of the Consent Order required EPA to respond to NL's submittal within thirty days. EPA was further required to enter dispute resolution procedures if it did not approve NL's submittal. As of this date no response has been received and EPA has refused to enter into dispute resolution.

addendum prepared by EPA selecting Remedial Alternative H. As the following comments will show, this arbitrary and capricious rejection of Alternative D is not supported by the evidence.

III. NL'S RECOMMENDED ALTERNATIVE D FULLY COMPLIES WITH EPA'S INTERIM GUIDANCE ON ESTABLISHING SOIL LEAD CLEAN-UP LEVELS.

In September, 1989, after the preliminary feasibility study for the Taracorp site had been completed, EPA Headquarters issued Interim Guidance on Establishing Soil Lead Clean-up Levels at Superfund sites.³ The Guidance sets forth an interim soil clean up level for total lead in residential areas at 500 to 1,000 ppm, which is adopted from a 1985 Center for Disease Control (CDC) Publication "Preventing Lead Poisoning in Young Children."

The CDC Publication itself does not recommend a clean-up level for lead in soil, however. Based on its review of lead exposure studies, it suggested that "lead in soil and dust appears to be responsible for blood levels in children increasing above background levels when the concentration in soil or dust exceeds 500 to 1,000 ppm." No indication is provided of the background level used or of any potential

³ EPA's issuance of the Interim Guidance has been challenged by the Atlantic Richfield Company in a suit filed in the United States Court of Appeals for the District of Columbia, on the grounds that EPA failed to comply with notice and comment procedures for rulemaking when it issued the guidance.

occurrence of adverse effects following exposure to soil or dust levels in this range.⁴

Within this framework, the Interim Guidance explicitly provides that "site specific conditions may warrant the use of soil clean-up levels below the 500 ppm level or somewhat above the 1,000 ppm level," providing flexibility on either end of the range. It emphasizes that the Administrative Record supporting the clean-up level should include background documents on the toxicology of lead and information related to site-specific conditions.

EPA has ignored this flexibility inherent in the guidance, however, failing to recognize that a range of clean-up levels from 500 to 1,000 was provided so that site-specific factors may be taken into account. Instead of examining these factors and incorporating them into a proposed clean-up level, EPA seemed to randomly pick a 500 ppm level with no relation to site conditions. It has struggled to articulate the scientific reasons for selecting the 500 ppm level ever since. When compared to the laborious process undertaken by NL to support its 1,000 ppm level, this effort falls far short of EPA's legal responsibilities under CERCLA to

⁴ Review of the CDC document makes clear that it never intended the 500 to 1,000 ppm level to be considered as a "recommendation" and adopted as a soil cleanup level. As the attached comments submitted to Jonathan Z. Cannon by ARCO demonstrate, there is no scientific documentation in the CDC document to support the interim cleanup level. See Exhibit A.

choose a cost-effective remedy which is sufficiently protective of human health and the environment.⁵ EPA has provided no scientific justification whatsoever for its arbitrary rejection of NL's risk assessment which complies with the Guidance, the Consent Order and EPA policy.

A. NL's Risk Assessment Complies With The Guidance By Taking Into Account Site-Specific Conditions.

NL's risk assessment included an analysis and review of a local blood/lead study conducted by the Illinois Department of Health, a toxicology assessment based on a modified reference dose developed pursuant to EPA policy and a Soil Lead Blood Lead Correlation Approach. The risk assessment addressed site-specific conditions including ambient air concentrations in Granite City, dietary intake of Granite City residents and soil lead intake. All three approaches were arbitrarily rejected by EPA.

5 Moreover, EPA asserted at the February 8, 1990 public hearing that it chose the lower end of the 500-1000 ppm range presented in the guidance in part because Granite City is an urban, industrial area, and therefore, the population may be exposed to other contaminants. This approach is unorthodox, unscientific and unsupported by the facts. First, there is no evidence in the record to indicate that there are other pollutants that threaten the health of the Granite City population, nor was any risk assessment conducted to evaluate the effects of other pollutants alone, or in combination with lead. Second, the literature is devoid of any reference to recommending a lower cleanup level of lead in soil where other pollutants are present, nor has EPA cited any scientific support for this synergistic approach. Thus, this statement, like much of what EPA relies on as support for its decision, does not withstand scrutiny.

1. The Illinois Department of Health Blood Lead Survey Provides the Best Information on Lead Exposure in the Granite City Community.

As part of its risk assessment, NL reviewed the data from the Illinois Department of Health (DOH) Blood Lead Surveys conducted during 1979 and 1982 summarized in the IEPA report "Study of Lead Pollution in Granite City, Madison and Venice, Illinois, April, 1983." This study, conducted while the Taracorp Smelter facility⁶ was still in operation, found that "high absorption of lead is not occurring" in Granite City and there was no "unusual incidence of elevated blood levels."

The DOH blood-lead study provides the best and most relevant information to understand the relationship between lead-bearing soils surrounding the Taracorp site and any health risk to nearby residents from elevated blood-lead levels. EPA summarily rejected the data from this study, however, because it was conducted in November and December, when it believed residents were less likely to be outdoors. Using unreferenced values for blood lead declines, the Agency estimated the peak blood lead might have been 15 to 20% higher if the survey had been conducted in the summer or late fall. The U.S. EPA Review of the National Ambient Air Quality Standards for Lead (1989) cites data indicating that the half-life for clearance of lead from the blood of children is 10 months, however, with a rate

⁶ The Smelter facility was identified by IEPA as a major source of lead. It was shut down in 1983 and is no longer operational.

constant of 0.072 per month. Thus, in the absence of any external uptake of lead over the period in question (an obviously theoretical assumption in Granite City or elsewhere in the U.S.), blood lead should decline by only 7.2% per month. In other words, the mean blood lead level of 10 ug/dl reported in the IDPH report for November might have been 12.3 ug/dl in September, if no lead exposure had occurred in the three month period.

The IDPH report also contains data on the levels of free erythrocyte protoporphyrin (FEP) in blood. FEP is formed when zinc is incorporated into heme instead of iron during erythrocyte formation, due to the inhibitory effect of lead on the enzyme ferrochelatase (U.S. EPA 1986). It is a longer term indicator of lead exposure than blood lead, because the life of an erythrocyte is approximately 120 days. Thus, if lead exposure had actually been higher during the summer and early fall months as EPA alleges, FEP concentration should have been elevated during the November/December sampling period. It was not elevated, however, according to the IDPH survey, indicating that the results of the study were a valid indicator of blood lead, even for summer months when outdoor activity may be more frequent.⁷

⁷ As IDPH points out in its report, one or two cases of elevated FEP should have been found in a sample of 46 urban children.

Therefore, the Agency's position that summer blood lead values may have been elevated relative to the time of the IDPH survey is incorrect, both because it uses an assumption of no significant exposure to lead over the period between summer and late fall (ignoring ambient exposure sources such as diet, house dust and air), and because FEP levels were not elevated.

Moreover, the blood lead and FEP testing conducted by IDPH indicate that soil lead concentrations in Alternative H's proposed remedial Areas 4-8 were not causing public health risks at that time. Therefore, the need to remediate these areas as proposed under Alternative H is not supported by the public health data.

Although a final report of the 1982 Granite City blood lead survey was never prepared by IDPH, summary tables of the survey were provided by IDPH, which break down data by age, sex, and location for both blood lead and FEP. Data for children aged 1 to 6 in Granite City were extracted for analysis (Exhibit B). Table 1 presents these data for the total 33 children's samples provided as a function of sectors of the study area EPA (Figure 4-5). The data show a decreasing trend in lead exposure with increasing distance from the Taracorp site, with mean blood and FEP levels of 17.1 to 33.5 mg/dl and 16.8 to 16.1 mg/dl for Sectors 2 and 3 respectively. Using the most recent guidance available for blood lead exposure parameter of concern (ATSDR 1988) with consideration of a proposed revision for blood lead of 15 mg/dl, none of the

33 children analyzed showed a combination of blood lead exceeding the current or proposed action level for lead exposure.

Furthermore, two predominant sources of lead in the study area - active smelting operations and use of the leaded automobile fuels were present at the time of the IDPH study, but are not present now. As discussed in Section III.A.3. of these comments, U.S. EPA (1989) has reported that the average blood lead levels of children have decreased from 14.9 ug/dl in 1978 to a projected 4.2 to 5.2 ug/dl in 1990. Therefore, blood lead levels of Granite City residents should have substantially decreased since 1982, meaning the values in the study are likely overstated.

2. The ADI Approach is an Acceptable Approach Given O'Brien & Gere's Development of a Modified Reference Dose.

In its comments, EPA criticized the Acceptable Daily Intake (ADI) Approach proposed in NL's risk assessment because the Agency has withdrawn its ADI for chronic exposure (ADIC) for lead. The new Risk Assessment Guidance for the Superfund Human Health Evaluation Manual (HHEM, 1989), however, provides guidance on the derivation of toxicity values even in the absence of EPA-verified values. It is possible to independently generate such values with the approval of the U.S. EPA's Environmental Criteria and Assessment Office (ECAO). As documented in previous correspondence submitted to this

record,⁸ such an approach was taken with the Granite City risk assessment, whereby the previous AIC was reduced by 40% in proportion to the anticipated lowering of the CDC level of concern for blood lead from 25 to 15 ug/dl. Dr. Michael Dourson of ECAO concurred that such an approach might be a reasonable alternative until additional guidance is forthcoming from the Agency.

The Agencies rejected the ADI approach, however, for Granite City, presumably because it assumes thresholds for lead. Such rejection may be based on the implied conclusion that there is no threshold effect level for lead in children, a position that is unsupported by the record or scientific principles. For example, a lowest observed adverse effect level (blood concentration) for lead in humans is cited by Madhavan et al. (1989) as 10 ug/dl (p. 137) because this level was the lowest associated with the inhibition of the enzyme ALAD (delta-aminolevulinic acid dehydrase), a key enzyme in the biosynthesis of heme. However, this inhibition is translated into decreased hemoglobin levels and anemia only at substantially higher blood lead levels -- 40 to 80 ug/dl -- based on a number of investigations reviewed in the ATSDR

⁸ See December 16, 1988 letter to Mr. Brad Bradley and Mr. Ken M. Miller from Bonni Fine Kaufman, with attachments.

Toxicological Profile for Lead (draft 1988).⁹ Thus, ALAD inhibition at 10 ug/dl should be viewed as a biological indicator of lead exposure, rather than an overt adverse effect. Given the existence of an appropriate threshold effect level of 25 ug/dl for lead or a proposed level of 15 ug/dl, the ADI approach is a valid method of risk assessment, supporting NL's proposed 1,000 ppm clean-up standard.

3. The Soil/Blood Lead Slope Proposed in NL's Risk Assessment is Consistent with Recent Studies of Lead Exposures As Well As Recent EPA Air Policy.

A critical review of post-1980 information on lead exposure indicates substantial decreases in baseline lead exposure, due primarily to the phasedown in leaded fuels and other lead uses. Since this phasedown beginning in the mid-1970's, there has been a dramatic decrease in the blood lead content of the United States population, as well as an apparently lower contribution of soil lead residues to blood lead content. As explained below, these contemporary data are more relevant to the remediation of the Taracorp site than the older studies relied upon by EPA and provide ample basis for the risk assessment's soil/blood lead slope.

⁹ This would appear to be due at least in part to the observation that approximately 90% or more of ALAD activity can be lost without measurable effect on the rate of heme synthesis (O'Flaherty 1981, p. 287).

The original risk assessment for Granite City uses a soil/blood lead slope of 2 ug/dl lead per 1,000 ppm increase in blood lead. This slope was based on the analysis presented in EPA'S Air Quality Criteria for Lead (1986), which suggested that a slope of 2.0 ug/dl per 1,000 ppm soil lead may represent a reasonable median estimate for a soil/blood lead slope. Three recent empirical studies, Stark et al. (1982), Rabinowitz and Bellinger (1988), and Johnson and Wijnberg (1988) indicate that the relationship between blood lead concentrations and soil lead ranges from 0.6 to 1.8 ug/dl per 1000 ppm, indicating that 1,000 pm will be protective of public health at the Taracorp site.

First, Stark et al. (1982), conducted a study of the exposure of urban children to soil lead from 1974 to 1979 in New Haven, Connecticut using 153 children of age 0 to 1 year, and 334 children of 2 to 3 years, and soil ranging in lead content from 30 to over 7,000 ppm. An analysis in U.S. EPA's Air Quality Criteria For Lead (1986) of the data in this study gave a slope estimate of 1.8 ug/dl blood lead per 1,000 ppm soil lead. U.S. EPA identified this slope as a good median estimate of the relationship between soil and children's blood lead. It has been incorporated into the Granite City/Taracorp risk assessment slope of 2 ug/dl blood level per 1,000 ppm soil lead.

Second, Rabinowitz and Bellinger (1988) conducted a study similar to Stark et al. of a population of children in

Boston during 1981. The study used a sample size of 195 children aged 6 months to 24 months and a range of soil lead of 7 to 13,240 ppm. The population was divided approximately evenly into populations of children with more mouthing activity and those who were said to finger and hand mouth less, which was determined by a statistical analysis of psychologists' judgments on the frequency with which the children placed their fingers, hands, or foreign objects in their mouths. (This distinction is important as high hand to mouth activity may lead to relatively higher exposure to soil and dust lead residues.) The slope estimate for the less mouthing group was 0.57 ug/dl per 1,000 ppm (standard error of 0.2), and 1.6 ug/dl per 1,000 ppm of lead (standard error of 0.5) for the greater mouthing group,¹⁰ once again less conservative than the 2 ug/dl per 1,000 ppm slope in the NL risk assessment.

Third, Johnson and Wijnberg (1988) conducted a study commissioned by the Centers for Disease Control in 1983 of children living in the vicinity of the ASARCO lead smelter in East Helena, Idaho. These investigators derived a slope

¹⁰ Because the study population did not live in crowded conditions which might enhance exposure to leaded paint residues in soil near houses, the authors caution that the slope might be steeper under more crowded, urban environmental conditions.

estimate of 1.4 ug/dl per 1,000 ppm lead, with a soil range of 158 to 1,549 ppm studied.¹¹

These recent studies, taken as a whole, show that the contribution of soil lead to children's blood lead may be substantially less than originally thought, validating the 2 ug/dl per 1,000 ppm slope used in NL's risk assessment.

Moreover, as reviewed and documented in the U.S. EPA Review of the National Ambient Air Quality Standards for Lead (1989), general lead exposures have been declining rapidly, not only because of the phasedown of leaded gasoline, but also due to the elimination of the use of leaded solders in metal food containers and the replacement of water distribution systems containing leaded solders. For example, estimates of mean dietary lead exposure in children was reported to have decreased from 52 ug/day to 8.8 ug/day between 1978 and 1990 (p. C-9). The U.S. EPA Review of the NAAQS for Lead (1989) was reviewed and approved by the U.S. EPA Clean Air Scientific Advisory Committee which estimated, through the use of a validated biokinetic lead exposure model and the 1978 NHANES II blood lead data, decreases in children's blood lead due to phasedown of leaded gasoline of 8.6 ug/dl, decreases in blood

¹¹ The data of Johnson and Wijnberg (1988) were also used by U.S. EPA (1989) to successfully validate its mathematical biokinetic model predicting blood lead levels in various age groups based on uptake, absorption and elimination rates via several physiological compartments and exposure routes.

lead due to decreased dietary lead exposure of 0.9 to 1.8 ug/dl, and decreases in maternal lead exposure producing decreased blood lead of 0.2 to 0.3 ug/dl. As a result, blood lead levels of 2 year old children in 1990 should average (geometric mean) from 4.2 to 5.2 ug/dl (compared with the average 1978 value of 14.9 ug/dl), and also from 3.5 to 5.8 ug/dl in adults (down from average values of 10.8 to 17.7 ug/dl) (see Table C-5, U.S. EPA 1989). These values, combined with the lower contribution from soil lead, and the fact that the IDOH blood lead study showed that residents of Granite City do not have elevated blood lead levels, indicate that the 1,000 ppm clean-up standard in Granite City will be fully protective of public health.

**IV. THE INFORMATION CITED BY EPA TO SUPPORT A 500 PPM
CLEAN-UP LEVEL IS IRRELEVANT TO GRANITE CITY
CONDITIONS AND RELIES ON OUTDATED INFORMATION.**

To support its preferred Alternative D, NL developed a three-pronged site specific risk assessment which has been updated by detailed information presented in these comments. In contrast, to justify its selection of Alternative H, EPA has relied on two generic vegetable uptake studies, an analysis of an outdated data set on lead exposure and a Superfund Record of Decision.¹² Upon review, it is readily apparent that these

¹² EPA has also referenced a draft ATSDR risk assessment of the Taracorp site. The ATSDR did not undertake a site-specific risk assessment for lead, however, it simply referenced the CDC guidance.

studies and the United Lead Scrap Record of Decision are completely irrelevant to conditions at the Taracorp site and do not provide a basis for a 500 ppm clean-up level. In fact, if the data in these studies are applied correctly, they support the 1,000 ppm level proposed in Alternative D.

A. The Results Of The Vegetable Uptake Studies Are Not Appropriately Applied To Granite City.

The first two studies relied upon by EPA, (Spittler and Feder 1979) and (Bassuk, 1986) examine vegetable uptake of lead and the methods to reduce such uptake. The Study of Lead Pollution in Granite City, Madison and Venice, Illinois conducted by IEPA in 1983, however, concluded that garden vegetables grown in the vicinity of the smelter do not appear to pose a significant risk. This site specific data should clearly take precedence over two generic vegetable studies that have no relation to Granite City soil conditions.

The IEPA study (1983) surveyed a variety a vegetables grown in Granite City gardens. As reported on page 37 of the study, vegetables grown in soils containing 53 to 97 ppm lead showed mean wet weight concentrations of 0.009 ppm, compared with 0.17 ppm for crops grown in soils of 1,100 to 1,500 ppm lead. In contrast, lettuce raised under greenhouse conditions by Spittler and Feder (1979) in 1,000 ppm soil lead contained approximately 3.1 ppm total lead (wet weight), almost 20-fold higher than the measured Granite City samples. Combining these data with an analysis of the dietary contribution of home-grown

vegetables, and consideration of the limited extent of vegetable gardening in Granite City, IEPA (1983, pp. 38 and 48) concluded that vegetables did "... not appear to pose a significant risk as long as they are thoroughly washed before eating."(p. 48). Therefore, as will be shown below, the results of the Bassuk and Spittler and Feder studies are completely irrelevant to the derivation of soil lead remedial objectives for the Taracorp site.

1. The Bassuk Study.

The purpose of the Bassuk Study was to determine the effect of the phosphorus content in soil on lead uptake in plants as a function of soil lead concentration. The study used a soluble lead compound, $PbCl_2$, to determine lead uptake by lettuce.¹³ In contrast, as stated on page 54 of the RI report, due to their smelting operation origin, the soil lead compounds at the Granite City site are likely to be oxides, sulfides, and mixed oxide/sulfates which are insoluble in water (Budavari 1989). Their insolubility is also indicated by the negative EP TOX results in the RI/FS from a soil sample with a total lead concentration of 3110 mg/kg (dry weight) (page 35 of the RI report).

Metal uptake by plants is directly proportional to the solubility of the metals in soil (Logan and Chaney 1983). Due

¹³ The aqueous solubility of $PbCl_2$ is 9.9 g/L at 20/C (Weast 1973), making it a relatively soluble lead compound.

to their relatively low water solubilities, the uptake by lettuce of the lead compounds at the Granite City site will be lower than in the Bassuk study where $PbCl_2$ was used. The extent of lead uptake by lettuce plants determined using the more soluble $PbCl_2$ cannot therefore be used as a measure of uptake of the relatively insoluble Granite City site lead compounds.

Moreover, no data were provided in the Bassuk study on the simple relationship between soil lead concentration and the extent of lead uptake by the lettuce. All the data are concerned with the effect of phosphorus on this relationship. What would have been more relevant to the site would have been a determination of the relationship between lead in soil and lead uptake unconfounded by the added factor of the phosphorus. To ignore the effect of phosphorus and simply apply the data to the site as a guide to the relationship between soil lead concentration and plant uptake is not scientifically valid.

Finally, nowhere in the Bassuk study are there any data to support selection of 500 ppm lead in soil as an acceptable remedial level based on agricultural or other land use. In fact, the data provide no basis for differentiating between 500 ppm and 1,000 ppm soil lead remedial objectives based upon lettuce uptake.

2. The Spittler and Feder Study.

The Spittler and Feder (1979) study similarly cannot be used as a valid basis for setting Granite City site clean-up objectives. The study was designed to determine the relationship between lead uptake by various common garden plants and the concentration of lead in urban soils. While the results clearly show the dependence of lead uptake on soil lead concentrations under the study conditions, the design of this experiment makes it of questionable relevance to the Granite City site. Moreover, the failure to document study conditions which would increase the bioavailability of the lead studied means the results cannot appropriately be applied to Granite City.

The major problem with the Spittler and Feder study is that it was conducted in a greenhouse rather than a field setting. It has been shown that the uptake of certain metals such as Zn, Cd, and Mn by plants is up to 5 times higher in greenhouse studies than in field studies (Logan and Chaney 1983). It is probable that lead is also subject to this phenomenon and the amount of lead actually observed in the field (i.e. garden) would be expected to be lower than observed in the Spittler and Feder greenhouse study.

This "greenhouse effect" is the result of several factors. First, the use of $\text{NH}_4\text{-N}$ fertilizers in pots in the greenhouse has the effect of lowering the pH of the soil directly adjacent to the plant roots. This results in higher

metal solubility, and consequently greater bioavailability (Logan and Chaney 1983). Abnormal watering patterns and the relative humidity of a greenhouse contribute to this effect. In contrast, the maximum growth rates achieved within a greenhouse cannot be achieved in Granite City because such conditions do not exist naturally. Therefore, lead uptake in Granite City vegetables will be lower.

The description of study procedures presented in Spittler and Feder was clearly inadequate to determine whether the conditions responsible for the greenhouse effect were present. Consequently, the study results are not likely characteristic of growth conditions in a typical urban garden, but of greenhouse conditions that would result in higher uptake levels. Without specific details on study conditions, it is improper to rely on these data to predict garden vegetable lead uptake levels.

Moreover, several additional factors important for the determination of the bioavailability of lead in soil were not addressed in the study. The most important of these factors is the pH of the soil. As the soil pH decreases, the solubility of metal compounds typically increases, causing an increase in bioavailability (Logan and Chaney 1983). No soil pH data were given in the study. Without such data, it is not possible to use the study to predict the extent of lead uptake by plants in other areas, including Granite City.

As the Bassuk (1986) study demonstrated, the concentration of phosphorus in the soil also has a pronounced effect on the extent of lead uptake by lettuce. Specifically, as the concentration of phosphorus in soil rises, the amount of lead taken up by lettuce decreases. Since Spittler and Feder (1979) did not measure the phosphorus concentration of the soils used to conduct their study, it is not possible to determine how widely applicable their data are. This is a particularly critical point, because serious vegetable gardeners routinely amend their soils with organic and inorganic fertilizers, mulches, and other additives, the majority of which would act to reduce lead solubility and plant uptake.

The study also fails to analyze the nature of the lead compounds that were accumulated from the soil by the crops. The lead compounds at the NL Granite City site are relatively insoluble, having been weathered in the years since their original release as a result of smelting operations. The lead compounds contained in the soils used by Spittler and Feder were likely derived from lead paints and auto exhaust. In the case of auto exhaust at least, the lead compounds are likely halides and mixed lead halide/ammonium halide double salts (U.S. EPA 1986), which will be much more soluble than the NL Granite City site lead compounds (Budavari 1989), and therefore have greater bioavailability.

The final problem with EPA's reliance on this study is that the study contains absolutely no rationale or support for selecting the 1000 ppm and 500 ppm advisory soil lead levels. These guidelines were simply stated to have been recommended to the Boston Gardening Community. There was no assessment of the risks that pertain to such soil lead levels and they were presented without derivation. Based on the lack of substantiation for the selection of these levels, and the fact that the experiment conditions under which the study was conducted were not similar to conditions at the Granite City site, the use of this study to set lead clean-up levels for Granite City is clearly not supported by the data presented. The obvious conclusion is that the IEPA study of the Granite City garden vegetables is a more appropriate site-specific site evaluation of lead uptake in Granite City vegetable gardens.

- a. Application of the Spittler and Feder results to Granite City shows no increase in lead exposure.

Even if one were to accept Spittler and Feder's uptake calculations for lettuce and other vegetables, which is clearly not recommended, the following calculations show that the resultant blood lead increase projected by the study for Granite City residents is not of concern. Spittler and Feder's study shows that lettuce grown in greenhouse conditions in Boston garden soil at 1,000 ppm lead contained 55 ppm dry weight, and 3.14 ppm wet weight. Values for 500 ppm were 30

ppm dry weight, and 1.71 ppm wet weight. Values for radish tops (a possible surrogate for other vegetable types) were approximately 50% of the lettuce values, and radish root even less. The EPA Exposure Factors Handbook (EFH 1989) summarizes adult dietary intakes as 200 g per day of total vegetable consumption, 40 g of which are lettuce. The handbook also presents a reasonable worst case, whereby 80 g per day of vegetables are homegrown over 50% of the year, or 40 g per day on a yearlong basis (10 g as lettuce). Thus, for a garden plot containing 1,000 ppm soil lead, the increase in blood lead due to consumption of the garden vegetables is as follows:

	<u>ppm fresh weight</u>	<u>ug Pb/ingested/day</u>	<u>increase blood Pb*</u>
lettuce	3.1	31	0.99
other vegetables	1.5	45	1.44
Total		76	2.33

* U.S. EPA (1989): blood lead increases 0.032 ug/dl per ug lead ingested for adults

The increase at a corresponding 500 ppm soil lead would be approximately 1.2 ug/dl.

It is not probable that young (ca. 2 year old) children would consume fresh vegetables at these rates. A 7 kg child (10% adult weight) who did so proportionally on a body weight basis would ingest 7.6 ug lead per day, and absorb 3.8 ug approximately. The children's relationship between absorbed lead and blood lead is 0.38 ug/dl per ug absorbed (also from the U.S. EPA (1989) OAQPS biokinetic model) or 1.4 ug/dl blood

lead increase at 1,000 ppm soil lead and 0.7 ug/dl at 500 ppm. In the context of projected baseline blood lead of 5 ug/dl and the exaggeration of lead/plant uptake by the Spittler and Feder study design, these estimated increases in blood lead are of no concern. Therefore, neither the study nor its predicted impact in Granite City provides a basis for a 500 ppm soil lead clean-up standard.

B. The Madhavan Study Is Drawn From A Biased Sample Of Outdated Studies And Does Not Support EPA's Clean-Up Standard.

The third study, (Madhavan, Rosenman & Shehata) cited by EPA to support Alternative H relies entirely upon older, pre-1975 data on lead exposures and ignores more recent data suggesting that the contribution of soil lead to children's blood lead may be substantially lower than originally thought. As discussed in the preceding section, downward trends in the level of lead exposure in the United States render the Madhavan conclusions of questionable contemporary significance. In addition, the study selection method used by Madhavan et al. was biased and used an invalid data point.

Madhavan et al. used a compilation of studies on blood lead and soil exposure conducted primarily before 1975 contained in Duggan (1980). In Duggan's analysis of the available literature, 21 blood lead/soil and/or dust lead correlation studies were listed, with correlation slopes for the contribution of soil and/or house dust lead, ranging from

1.6 to 14 ug/dl per 1000 ppm soil lead (some of which represent averages of replicate studies within a single cited source). Duggan (1980) selected 19 of these values which showed a statistically significant difference in the range of soil lead concentrations measured, and derived an estimated increase (both arithmetic mean and median) of the order of 5 ug/dl per 1000 ppm of soil or dust lead (p. 316).

Madhavan et al. selected only 8 of the 21 individual blood lead/soil lead correlation estimates, ranging from 0.6 to 65.0 ug/dl per 1000 ppm, from the Duggan compilation for their analysis. The intent was to isolate uptake in children less than 12 years of age ("... the most susceptible group to lead toxicity"...) and to eliminate the influence of other sources of lead exposure (house dust was cited, p. 138). No other justification was provided for the selection of these eight values. In fact, Duggan (1980, p. 312) notes that there was no clear separation of the slope values seen in soil studies vs. house dust studies. This opinion was confirmed by U.S. EPA (1989). Thus, the basis for study selection in the Madhavan et al. analysis is questionable, particularly the exclusion of house dust studies because these studies would include lead from the soils as well. This diminishes the statistical confidence of the resulting estimate of slope.

Madhavan et al. also determined a geometric mean (based on an assumption of lognormal blood lead distribution) for the 8 studies taken from Duggan (1980) of 3.41 ug/dl per

1000 ppm soil lead with a geometric error of 1.75 ug/dl. An upper bound 95% confidence limit of 8.5877 ug/dl per 1000 ppm is reported. Examination of the table in Duggan (p. 313) from which the 65.0 ug/dl per 1000 ppm value (from the Angle et al. reference) was selected by Madhavan indicates that the soil lead residue range was considerably less than 1000 ppm (97 to 219 ppm), and that the variation was not considered statistically significant. Thus, this value cannot be considered a "slope" describing the incremental contribution of increasing levels of soil lead to blood lead, as mistakenly represented by Madhavan et al. (p. 139, Table 1). It represents only an estimate of blood lead obtained by extrapolation from a single soil lead level typical of urban background levels, and measured blood lead levels of 14 to 22 ug/dl, to a hypothetical soil lead level of 1000 ppm.

Derivation of a valid correlation slope requires that the independent variable(s) be measured over a statistically significant range of values, encompassing the entire range of interest. It is therefore inappropriate to include the value of 65.0 ug/dl per 1000 ppm in the statistical treatment of estimated slopes, because it is not a slope. Neither Duggan (1980, p. 316) nor U.S. EPA (1986) included this value in their analyses of soil lead uptake in children. Furthermore, 65 ug/dl of children's blood lead represents a potential effect level for lead toxicity in children for effects including anemia and neurotoxicity (ATSDR 1988, CDC 1985). Such readily

observed toxicity indicated in Madhavan et al. to be associated with soil lead levels of 1000 ppm is not consistent with public health investigations conducted in Granite City (as reviewed in the Granite City RI report), which did not reveal elevated lead exposure. Nor is it consistent with clinical manifestations of toxicity noted in other reviews, including CDC (1985) and EPA Air Quality Criteria for Lead (1986).

Excluding the highest value in the Madhavan et al. (1989) data set from the calculation (65.0 ug/dl per 1,000 ppm), reduces the 95% upper confidence estimate of the slope to 4.52 ug/dl (Madhavan et al. 1989, p. 140)). This would correspondingly increase the maximum permissible soil lead level derived by the Madhavan et al. (1989, p. 140) approach to 1200 ppm, rather than the 600 ppm level proposed in the study. This soil lead level is clearly inconsistent with the 500 ppm level proposed by EPA.

The Madhavan study has also erroneously assumed that lead uptake is linear with concentration to reach their proposed 600 ppm level. Madhavan et al. presents a table which assumes a linear relationship between blood lead and soil lead down to a slope of 1 ug/dl per 116 ppm soil lead. The basis for this assumption of linearity, however, is not provided. In fact, in citing the Centers for Disease Control (CDC, 1985) review of some of the same information utilized by Duggan (1980), Madhavan et al. appear to contradict their own assumption of linear uptake. Specifically, CDC concludes: "In

general, lead in soil and dust appears to be responsible for blood lead levels in children increasing above background level when the concentration in the soil or dust exceeds 500-1000 ppm." This statement clearly suggests that soil lead of less than the 500 to 1000 ppm range does not result in observable blood lead increases.

Choosing 5 ug/dl as a "tolerable" level of blood lead to be added to baseline blood lead, Madhavan et al. (1989, p. 140) present the associated value of 600 ppm of soil lead from their linear analysis as a protective level, adding the 5 ug/dl incremental blood lead increase to 1976 - 1980 baseline blood lead medians of 16 and 20 ug/dl. Since the U.S. EPA Review of the NAAQS for Lead (1989) determined that 1990 blood lead values in children should be of the order of 5 ug/dl (p. C-14) the 600 ppm level is obviously significantly overprotective.

1. A correct analysis of the Madhavan data supports the 1,000 ppm clean-up standard.

Utilizing data from Stark et al. (1982) and Rabinowitz and Bellinger (1989), further supported by the CDC's ASARCO study (Johnson and Wijnberg 1988), as well as estimates of current base-line lead exposure, it is possible to utilize the approach of Madhavan et al. to derive an alternative clean-up objective for soil lead in Granite City based on more contemporary data.

Rounding the slope of the Stark et al. (1982) and the Rabinowitz and Bellinger (1988) high mouthing behavior study group to 2.0 ug/dl per 1,000 ppm lead, and adding 1.0 ug/dl (two standard errors on the geometric mean of the Rabinowitz and Bellinger (1988) study), it appears that exposure of a child with high hand to mouth behavior to soil lead levels of the order of 1,000 ppm will add approximately 3.0 ug/dl to baseline blood lead as an upper bound estimate using contemporary data.¹⁴ In view of recent projections (U.S. EPA 1989) that the national mean baseline blood lead concentration in young children may be up to 5.2 ug/dl (geometric mean), an upper bound estimate of childrens' blood lead resulting from exposure to 1,000 ppm soil lead appears of the order of 8.2 ug/dl. This level is below the blood lead level of 10 ug/dl incorrectly cited by Madhavan et al. (1989) as a lowest observed adverse effect level based on ALAD inhibition, and

¹⁴ Madhavan states that data on estimates of the amount of soil ingested by children show a 100-fold variation and thus are not useful in deriving a "safe" soil level for lead. Therefore, Madhavan et al. use information only on the relationship between blood lead concentration and soil concentration to derive their criterion. However, the sources cited by Madhavan et al. (1989) show good consistency in estimated soil ingestion rates (EFH, 1989). Both the Binder et al. (1986) and Clausen et al. (1987) studies directly measured children's soil ingestion in controlled experiments, and show less than a two-fold variation in mean daily soil ingestion rate (127 - 230 mg/day). Thus, an additional approach to lead exposure analysis was rejected incorrectly, even though U.S. EPA (1989) successfully used such an approach in developing its validated biokinetic lead exposure model.

considerably less than the 25 ug/dl represented by these authors to result from exposure to the 600 ppm maximum permissible soil lead level under the worst case conditions presented in that study.

A margin of uncertainty of approximately 2 ug/dl or more thus exists between the upper bound blood lead estimate of 8.2 ug/dl for exposure to 1,000 ppm soil lead and the Madhavan et al. 10 ug/dl lowest observed effect level for ALAD inhibition. This will allow for protection of site-exposed individuals who are at the upper end of both the 1990 baseline blood lead distribution (estimates of the geometric standard deviation were not available for the current mean estimate but are most likely to be less than the 1978 value of 1.4) and soil lead uptake distribution from overt lead toxicity (as opposed to ALAD inhibition alone). In consideration of the fact that the baseline blood lead already contains a contribution from baseline soil exposure of approximately 1 to 1.5 ug/dl from background soil lead of 180 ppm (calculated from Table 4-2, U.S. EPA 1989), the 1,000 ppm soil lead residues at the Taracorp/Granite City site will not represent a source of adverse health effects for the worst case exposure population.

C. The Cincinnati Work Plan Cited By EPA As Support For Its 500 ppm Level Also Has No Bearing On Granite City Conditions.

EPA has also cited the Cincinnati Soil Lead Abatement Work Plan as support for Alternative H. The Work Plan was

developed as part of the Cincinnati Soil Lead Abatement Demonstration Project, one of three such projects authorized by Section III(b) of SARA, which provides for: "a pilot program for removal [and] decontamination ... with respect to lead-contaminated soil in ... metropolitan areas." See generally Clark, et al., "The Cincinnati Soil-Lead Abatement Demonstration Project" (1989).

EPA's reliance on a lead-in-soil level used in a pilot program as authority for the selection of a cleanup objective for a National Priority List site is misplaced. The scientists carrying out the pilot study design their experiment to suit their hypotheses, and are free to do so with no regulatory, statutory, or other legal constraints. They could choose to examine the impact of absolutely any level of lead-in-soil. In contrast, in selecting a remedy for the Taracorp/Granite City site, the EPA must comply with the National Contingency Plan, Section 121 of SARA and the Consent Order.

Moreover, the Cincinnati project is designed as a research program to address several questions, first and foremost: "Does soil lead and exterior dust abatement in rehabilitated [lead paint-free] housing ... result in a statistically significant reduction in blood lead of children relative to children ... in a control area...?" Clark, at 292. The researchers would be inclined to abate lead-in-soil to a relatively low level, to insure that there will be a real statistically significant difference between the experimental

and control groups. It does not follow at all that the pilot program cleanup level should be applied to Superfund sites. To the contrary, funding of the pilot program may indicate Congressional awareness of the need for research in this field, and the lack of scientifically established remedial references.

Even if the Cincinnati work plan cleanup were carried out in Granite City, it does not go as far as Alternative H. The excerpts from the Cincinnati Work Plan state that the study areas selected had "the presence of a minimum [undefined] number of children under four years of age and the presence of lead contaminated soil" (p. 4-27). Thus, unlike Alternative H, which proposes a universal cleanup without reference to a protected population, the Cincinnati pilot program targets children under four years old. No such differentiation among affected residents has been proposed in Alternative H, indicating a substantial degree of overprotection at an extremely high cost.

D. EPA's Reliance On Other Records Of Decision To Select A Cleanup Level For The Taracorp Site Contravenes The Interim Guidance And Is Scientifically Inappropriate.

The purpose of the Interim Guidance is to require a site-specific analysis for selection of a clean-up level. EPA's asserted reliance on other Superfund Records of Decision (RODs) to select a clean-up level for Granite City not only contravenes this policy, but leads to an absurd result. This is obvious when the United Scrap Lead ROD is carefully analyzed.

The United Scrap Lead site only required removal of 1600 cubic yards of soil to achieve a 500 ppm level. In contrast, Alternative H would require removal of approximately 160,000 cubic yards of soil, resulting in adverse impacts to the community which were never considered at the United Scrap Lead Site. Moreover, since the United Scrap Lead site is located in a rural area, any adverse impacts from excavation and disposal of soils on the population would be minor, as opposed to Granite City, where the area to be remediated is densely populated. The United Scrap Lead site had additional pathways of potential exposure as well, via surface water and groundwater, which are not present in Granite City. Clearly, EPA's reliance on this ROD to support its 500 ppm clean-up level falls short of any reasonable scientific justification.

**V. ALTERNATIVE H IS NEITHER COST EFFECTIVE
NOR TECHNICALLY FEASIBLE.**

EPA's premature release of Alternative H prevented O'Brien & Gere, the engineers approved under the Consent Order, and the persons with the most knowledge and expertise about site from finalizing the feasibility study. Therefore, cost and technical data supporting EPA's proposed Alternative H were not analyzed by O'Brien & Gere before they were released to the public. As a result, the cost of Alternative H and time period for implementation have been significantly underestimated by EPA and technical roadblocks to implementing this Alternative were completely overlooked.

EPA's fact sheet on clean-up alternatives estimates that the total cost for implementing Alternative H is \$25 million. The implementation time is proposed to be 1.5 to 2.5 years. The actual cost of Alternative H will be close to \$30 million with an implementation time of 7 years. In contrast, Alternative D is estimated to cost \$6.8 million with an implementation time of 1 to 2 years.

The assumptions and methods used by NL to calculate the actual cost and implementation time for Alternative H are explained below.

A. Cost Estimate.

To determine the impact of adding the additional residential properties to the remediation area proposed in Alternative H, each block identified by the USEPA was evaluated by O'Brien & Gere. Aerial photographs taken during 1988 were generated at approximately 100 scale and the area occupied by each block (curb to curb) was calculated. In addition, estimates were made on the amount of unpaved surface on residential lots or alleys adjoining those lots. Exhibit C presents a Figure with the numbered blocks as well as a Table which includes the estimated unpaved residential surface area targeted for remediation.

The estimated cost of \$30 million assumes a pavement to sod ratio of 1:2 to reflect the residential driveways and the unpaved alleys through the middle of many blocks. The unit

costs for excavation were based on excavation of 50% of the material by small equipment (Bobcat or equivalent) and 50% manually. A drive-by survey of the targeted areas suggests that the teaming of laborers with a light piece of equipment is the method the contractor would use. The combined excavation cost derived from Means 1989 Site Work Construction Cost guide (Means) averaged \$31/CY. For the purposes of the Feasibility Study a combined cost of \$45/CY was presented. The incremental cost was added to reflect reduced production resulting from tight working conditions associated with minimizing damage to property and shrubs, as well as anticipated supplemental safety requirements. Restoration costs were based on site specific information and unit costs included in Means (see Exhibit D).

Exhibit D presents the detailed cost estimate for Alternative H using the same presentation format that was used in the Preliminary Draft Feasibility Study. The total estimated cost of \$30 million prepared using these methods is approximately 20% higher than the EPA's published value. The difference in costs is due to the methods utilized to estimate areas for remediation. O'Brien and Gere conducted a block by block tabulation of the area from aerial photographs while EPA simply scaled up the costs developed by O'Brien & Gere for Alternative D. In addition, EPA's estimate does not appear to include costs for remediating unpaved alleys and sidewalks in residential areas. Although a 20% deviation in costs during the Feasibility Study is within the range expected at this

stage in the project, the actual difference of \$5 million is substantial. For budget purposes a \$30 million value is considered more appropriate than the \$25 million value proposed by the U.S. EPA.¹⁵

B. Implementation Time.

The USEPA's fact sheet estimated that the implementation of Alternative H would require 1.5-2.5 years. Prior to the Public Hearing, calculations were conducted to provide an indication of project duration. Those calculations resulted in approximately seven years from authorization to begin design to contract closeout. The project duration can be separated into three phases: design, excavation/transport, and installation of the Taracorp Pile cover.

1. Design.

Final design will require supplemental sampling of each of the residential properties according to EPA comments at the February 9, 1990 public hearing. The areas to be evaluated include somewhat in excess of 1600 residences based on the aerial survey. Obtaining access for sampling, sampling, analyses, data validation and reporting is expected to take at least six months. Preparation of design documents, bid

¹⁵ The \$30 million figure does not include any additional monies necessary to purchase additional property for the expansion of the Taracorp pile proposed in Alternative H. See Section V, D.

preparation, contractor selection and award is expected to take an additional six months. This results in a one year design process.

2. Excavation/Transport.

The excavation and transport of approximately 160,000 cubic yards of soil to the Taracorp Pile is the major component of this project. Movement of SLLR piles and the removal of contained lead bearing wastes to recycling facilities are expected to require a short period of time and be able to be conducted simultaneously with other activities. Therefore, these activities were not factored into the estimated time frame.

A preliminary time estimate was prepared prior to the February 8 public meeting, by evaluating the production of a work crew consisting of four laborers, and an equipment operator using production rates quoted in Means. The results suggested that each residential property might require 5 days to complete the excavation of 6 inches of soil, replacement of 6 inches of soil, sodding/paving, and the replacement of shrubs as well as other incidentals. NL Industries' experience with similar cleanups suggests that the actual time might be closer to six days/residence. For preliminary estimating purposes a value of 5.5 was used. Remediation of 1690 estimated properties results in 9300 work days for a single crew. This is equivalent to 53 years when corrected for a five day work

week, 50 week work years, and 70% of the work days suitable for construction (reasonable weather conditions).

While sequence of construction will be determined by the contractor, for an initial estimate it was assumed that a particular work crew would have responsibility for both excavation and restoration of a given property. Each crew could send an estimated three truckloads of soil to the Taracorp pile/day during the 3.5 days estimated for excavation at each property. Using a round trip time of 1 hour between arrival at the residence for soil pickup and return to a residence for soil pickup results in eight 10 CY loads per day. Therefore, a truck could service three crews during excavation.

The number of crews which could work simultaneously may be limited by Granite City and would also be limited by truck access to the Taracorp Pile. Concerns raised at the public hearing suggest that vehicles leaving the Taracorp site will likely have to go through sufficient decontamination to prevent tires from tracking dust throughout the city. It was assumed that the time required to enter, dump, decontaminate, and leave the Taracorp site was 20 minutes. Using the staging/decontamination locations limits truck traffic to 48 loads per day. This traffic loading would allow a maximum of 16 crews to be excavating at any given time. Because the loading and unloading is unlikely to be perfectly scheduled, it was assumed that the contractor would elect to use twelve crews and thus minimize truck waiting time at the pile.

Applying twelve five man crews to the project supported by four full time trucks, resulted in an estimated residential excavation time of 53/12 or 4.4 years. Additional time will be required to excavate material from the alleys in Venice Township and Eagle Park Acres. Based on these calculations, an excavation/restoration period of 5 years was estimated.¹⁶

3. Installation of the Cap.

The time required to cap and close the pile after the soil transport is completed is estimated at one year. This time frame would include finish grading of the pile, installation of the two foot clay barrier, the synthetic membrane, drainage layer, filter fabric, root zone, and seeded topsoil. This assumes that during the soil transfer operations compaction and grading were ongoing with only marginal modifications expected during cover installation.

The time required to complete Alternative H within the budget estimate of \$30 million is thus estimated at

¹⁶ The time frame is substantially more than 1.5-2.5 years estimated by the USEPA. The USEPA did not provide any calculations to support the proposed implementation schedule, therefore, critical review is impossible. However, given the geometry of the existing Taracorp Pile, its relationship to 16th and State Street, and the need to minimize dust tracking through the city, it is unlikely that truck throughput could be increased substantially beyond that assumed. Using this method of estimating and crew size, the time frame to do a city block would range from 2-3 weeks depending on the block size.

approximately seven years, compared to one to two years for Alternative D. This increase is not unexpected when one considers that the estimate for Alternate D of 1-2 years includes only 220 residential properties to a depth of 3" while Alternative H includes 1690 properties to a depth of 6".

C. EPA Failed To Consider The Technical Infeasibility Of Implementing Alternative H.

Even more egregious than the errors in EPA's cost and implementation time estimate is EPA's failure to address the technical obstacles to implementation of Alternative H. Alternative H proposed to dig up soils from Areas 3 through 8 with lead levels greater than 500 ppm in residential areas and place the soils on the existing Taracorp pile. The pile will then be capped. EPA has erroneously assumed, however, that excavated material can be disposed on the Taracorp pile. The placement of an additional 160,000 cubic yards of soil on an 85,000 cubic yard pile will violate USEPA guidance for side slopes on waste piles¹⁷ and impair the physical integrity of the site. Therefore, EPA's option is to purchase the adjacent lot occupied by TriCity Trucking for disposal (which is in a 100 year flood plain) or dispose of the additional soil off-site. Off-site disposal will increase the cost of Alternative H by an additional \$5 million. Expansion of the Taracorp pile into a flood plain is truly nonsensical, if the

¹⁷ EPA 625/6 - 85/006 at p. 3-20.

purpose of this project is to prevent releases of lead into the environment.

Moreover, EPA's proposed Alternative H results in a five-fold increase in the areas to be remediated when compared to Alternative D. This enormous area of off-site remediation was never contemplated by O'Brien & Gere, and was only proposed by EPA after O'Brien & Gere's RI/FS work had been completed. Consequently, the remedial investigation does not include enough data points to identify and define the appropriate extent of Areas 4-8 to be remediated.

EPA's remedial Alternative H partially relies upon "Soil A" sample data selected from the "Study of Lead Pollution in Granite City, Madison and Venice, Illinois" (1983), p. 28-30. The IEPA report presented four distinct soil sample classifications or groups. "Soil B" samples, "which were intended to indicate levels to which children would most likely be exposed, were taken from open dirt areas in yards, playgrounds, etc." The soil B samples split between IEPA, IDPH, and USEPA were not considered during the development of Alternative H, however.

Moreover, the biased limited sampling data offered by USEPA to support such remediation was not reviewed in the RI. Amazingly, EPA has relied on only five residential soil samples to require the remediation of almost 600 residences in Area 4, and seven soil samples for the remediation of Area 8, which includes over 600 residences. It is clear that such limited

sampling provides an insufficient basis for the massive scale soil removal program proposed by EPA in Alternative H.

VI. ALTERNATIVE H'S INCREASED RISK TO RESIDENTS AND ADVERSE IMPACTS ON THE COMMUNITY AND THE ENVIRONMENT ARE NOT JUSTIFIED BY THE MINIMAL PROTECTION IT PROVIDES.

Implementation of Alternative H will result in the excavation and disposal of 160,000 cubic yards of soil compared to 23,000 cubic yards for NL's proposed Alternative D. EPA admits that the "amount of digging required could expose the community to contaminated dust." (EPA Clean-up Alternatives.) What it has not analyzed or made clear to the public is that Alternative H will have significantly more adverse community and environmental impacts than Alternative D.

First, Alternative H will require almost 40,000 Dump Truck Traffic loads traveling on Granite City streets, compared to 6900 loads for Alternative D. This results in a 600% increased risk of traffic fatality or injury -- which is a far more adverse impact than any increased lead exposure from a 1,000 ppm rather than 500 ppm clean-up level. Moreover, the adverse impact from air pollution due to vehicle emissions and unavoidable lead emissions from soil in dumptrucks as they travel through Granite City roads has not been considered.

Furthermore, excavation of this enormous volume of soil will have substantial construction impacts on the community with little benefit in return. Residents will be subject to noise, debris, traffic, parking restrictions, dust

and the general inconvenience of construction for several years as the project proceeds. It is difficult to even imagine the scale of a soil removal program encompassing 97 city blocks, let alone the consequences for the residents living through it.¹⁸

Section 121(b)(1)(b) of CERCLA, 42 U.S.C.

§ 6921(b)(1)(b), requires that when assessing remedial actions EPA shall, at a minimum, take into account the potential threat to human health and the environment associated with excavation, transportation, and redisposal, or containment. The National Contingency Plan similarly requires that the method and cost of mitigating adverse impacts be taken into account and that alternatives that have significant adverse effects with very limited environmental benefits should be excluded from further consideration. 40 C.F.R. § 300.68(g)(3), and (h)(vi). EPA has not provided any information in this record explaining how it proposes to mitigate the adverse impacts from this massive construction and excavation project, which will unavoidably increase lead emissions in the Granite City community. Nor has it provided valid scientific support for the implementation of a 500 ppm clean-up level. The failure to analyze the

¹⁸ In addition, EPA has not analyzed the impact on surface water and groundwater from its proposed use of wetting agents and surfactants to control dust during excavation. The cost of purchasing these materials as well as treating their discharge has not been addressed or included in EPA's cost estimate.

consequences of Alternative H on the Granite City community or justify the use of a 500 ppm clean-up level not only violates CERCLA, but the public's trust in EPA.

VII. CONCLUSION

NL has demonstrated in these comments that EPA's selection of Proposed Alternative H has no valid technical or scientific justification and falls far short of CERCLA's requirement of a cost effective remedy which will protect public health and the environment. In contrast, Alternative D will not only protect the residents of the Granite City community and the surrounding environment, it is cost effective and technically feasible in terms of project duration and ability to remedy and prevent future releases of lead into the environment.

NL performed a three-pronged site-specific risk assessment with detailed scientific references and provided the Agencies with numerous recent studies and information on lead exposure in support of the implementation of Alternative D. To support Alternative H, EPA relied on extremely limited data, which consisted of generic vegetable uptake studies irrelevant to the site, an outdated lead exposure review, a Superfund Record of Decision and a pilot program for lead remediation which has not even been completed. These comments demonstrate that each of these studies was irrelevant to Granite City conditions and/or based on outdated information on lead

exposure prior to the phasedown of leaded fuels. Moreover, EPA has completely failed to address the substantial adverse impacts on the community from the enormous excavation and construction required in Alternative H or the methods to mitigate such impacts.

When the record is reviewed as a whole, it is clear that EPA has no support for the selection of Alternative H as a remedy at the Taracorp site. Selection of such remedy and rejection of Alternative D is arbitrary and capricious, violating the requirements of CERCLA and the Administrative Procedure Act governing federal agency action.

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EXHIBIT A

ARCO Coal Company
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Richard Kraplin, Ph.D.
Manager
Environmental Projects



October 26, 1989

Mr. Jonathan Z. Cannon
Acting Assistant Administrator
Office of Solid Waste and Emergency Response
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Dear Mr. Cannon:

ARCO Coal Company, a division of Atlantic Richfield Company, submits the attached comments on EPA's "Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites" (OSWER Directive #9355.4-02), dated September 7, 1989. The Directive sets a cleanup level of 500-1,000 ppm for total lead which the EPA considers protective for direct contact in residential settings.

EPA states that it is adopting a recommendation ("...lead in soil and dust appears to be responsible for blood levels in children increasing above background levels when the concentration in the soil and dust exceeds 500 to 1000 ppm") contained in the 1985 Centers for Disease Control (CDC) document "Preventing Lead Poisoning in Young Children." Review of this document and personal communication with CDC staff indicate that CDC never intended the 500 to 1000 ppm statement to be considered a "recommendation" and adopted as a soil cleanup level. There is no scientific documentation in the CDC document or the EPA Directive to support the interim cleanup level.

Scientific justification must be provided by EPA in order to assure that any soil lead cleanup level is adequate to protect health. The Directive improperly rejects use of the EPA Integrated Uptake Biokinetic Model which has been demonstrated to be a reliable analytical method to determine the relationship between environmental lead concentrations and blood lead concentrations in EPA lead rulemaking. In addition, the Directive has not considered background blood lead levels, target blood lead levels after cleanup, population of primary concern, fraction of the population to be protected, nature and severity of health effects and factors which influence the bioavailability of lead.


Mr. Jonathan Z. Cannon
October 26, 1989
Page 2

If EPA uses the guidance document as it appears it was intended, the above inadequacies could be at least partially remedied by site-specific studies, as in an RI/FS leading to a remedial action. However, Region VIII intends to use the guidance as if it were a regulation, applying lead cleanup levels without site-specific study.

ARCO understands EPA's need to set cleanup standards and to move forward with Superfund cleanups as expeditiously as possible. Yet, the basis of a soil cleanup level for lead must be scientifically valid. Absent such validation, we urge EPA to hold off on actions proposed to be conducted without regard to establishing a scientific basis. Shortly, we will be sending you a proposed methodology for deriving site specific soil lead cleanup levels. Our methodology will include such factors as identification of the exposed population, determining background blood lead concentrations, blood lead levels contributed from soil, health criteria, fraction of the population to be protected and bioavailability. We would appreciate the opportunity to meet with you to discuss our methodology when it is completed.

We look forward to hearing from you at your earliest convenience regarding the attachment and anticipate further discussion on soil lead cleanup methodology.

Sincerely,



Richard Krablin, Ph.D.
Manager
Environmental Projects

Attachment

pc: J. L. Scherer/U.S. EPA
W. K. Reilly/U.S. EPA
H. L. Longest II/U.S. EPA
B. Diamond/U.S. EPA

bpc: D. E. Pizzini/Montana Department of Health & Environmental Sciences
K. Alkema/Utah Department of Health
T. Vernon/Colorado Department of Health
J. F. Wardell/EPA
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E. C. Tidball
W. R. Williams
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G. N. Bigham/PTI

ATTACHMENT TO LETTER TO JONATHAN Z. CANNON
DATED OCTOBER 26, 1989

Comments on "Interim Guidance on Establishing Soil Lead Cleanup Levels
at Superfund Sites" (U.S. EPA, September 7, 1989)

Introduction

On September 7, 1989, the Offices of Emergency and Remedial Response and of Waste Programs Enforcement of the U.S. Environmental Protection Agency (EPA) issued a directive setting interim soil cleanup levels for lead at Superfund sites (Longest and Diamond, 1989). The stated range of soil lead concentrations (500 to 1,000 ppm) is considered by these Offices to be "protective for direct contact at residential settings." The directive further states that additional soil cleanup guidance will be developed after the development of standard toxicity factors for lead (i.e., a Cancer Potency Factor and/or a Reference Dose for non-cancer health effects.)

The Agency's establishment of this cleanup range, as presented in the September 7 directive, suffers from numerous methodological and technical deficiencies. From a methodological perspective, the Agency provides little basis for selection of this range.

Instead, EPA states that it is adopting a "recommendation" of the Centers for Disease Control (CDC). The EPA directive provides no discussion of the target blood lead levels which would be expected following exposures to the soil cleanup levels, of the population of primary concern, or of the fraction of the population that would be protected by use of these guidelines.

EPA's inadequate technical basis is likely to reflect the limited technical justification provided by CDC in its derivation of this range (U.S. DHHS, 1985). As presented in both the EPA directive and the original CDC document to which the directive refers, the 500-1,000 ppm range is one which "appears to be responsible for blood lead levels in children increasing above background levels." Neither CDC nor EPA discuss critical factors for application of this soil lead range to site cleanup. Factors which should be considered include the magnitude of expected increase above background blood lead, the background blood lead level assumed, the nature and severity of health effects (if any) associated with such increases, or the individual and population significance of these health effects. Factors which influence the bioavailability of lead at specific sites, such as impacts of soil or other matrix composition (e.g., mining wastes), on lead uptake must also be considered. These concerns are presented in more detail in Comments 2 and 3 below.

In addition to providing insufficient technical justification for the values it has selected, the Agency's approach to setting these interim guidance levels ignores or inappropriately

dismisses substantial available information on lead toxicity, exposure, and risk. In particular, EPA fails to acknowledge significant differences in exposure mechanisms between fetuses (the primary population of concern for low-level lead exposures -- whose exposure is determined by maternal exposures) and young children (who have the most significant exposures to soil/dust lead due to enhanced soil/dust ingestion rates). The Agency also improperly rejects the use of the Integrated Uptake/Biokinetic (IU/BK) model, which provides important insights into the relationships between environmental concentrations of lead and blood lead levels. While EPA acknowledges the importance of consideration of relative bioavailability of different forms and particle sizes of lead, these data are not incorporated into the current cleanup guidance.

These comments as well as the appropriate incorporation of the IU/BK model and other generic and site-specific data into development of cleanup levels for lead are discussed in more detail below.

1 Numerous methodological and technical deficiencies exist in EPA's documentation of its interim soil cleanup levels for lead in soil.

One of the most significant problems with EPA's proposed interim soil lead cleanup guidelines is its failure to provide either the rationale or bases for selection of the 500-1,000 ppm range as the range of concern. The Agency does not identify the population

to be protected by these cleanup levels, e.g., young children with elevated soil ingestion rates or fetuses who may be more susceptible to the neurological effects associated with lead exposures. EPA also does not relate the soil cleanup levels to blood lead levels or adverse health impacts of concern, i.e., the adverse health impacts which would be avoided or mitigated by adhering to these cleanup levels are not specified. Information on the level of protection, e.g., the fraction of the exposed population which would not experience a particular adverse health impact or which would not exceed a certain blood lead level of concern, also is not provided in the directive.

The failure to present such information raises questions regarding the scientific validity of the selected soil concentration range. In addition, vagueness regarding the derivation procedures for the cleanup values presents difficulties for selecting specific site cleanup levels either within or outside the range. For example, the Agency acknowledges that "[s]ite-specific conditions may warrant the use of soil cleanup levels" which are not within the stated range. However, without any guidance as to the factors incorporated into the initial selection of the stated range, it is unclear how selection of a value within the range or modification of these cleanup levels could be undertaken. As discussed in Comment 3 below, site-specific considerations are likely to be significant enough to negate the usefulness of generic cleanup levels in favor of site-specific measures for all sites.

The absence of supporting information in EPA's guidance reflects the limited basis for derivation by CDC of the soil levels cited by EPA. As described in more detail in Comment 2 below, EPA's use of CDC's values is technically inappropriate as the soil levels were not necessarily associated with any adverse health impacts, but were merely described as being levels which appeared to elevate children's blood lead levels "above background." Other technical factors limiting the applicability of CDC's values for CERCLA use are decreases in children's blood lead levels since the time of CDC's assessment, and differences in the types of sites reviewed by CDC (largely urban conditions including lead paint exposures) compared with those for which the cleanup levels are intended (CERCLA hazardous waste sites, including mining sites). It should also be noted that there is no indication CDC ever intended these soil values to serve as cleanup guides (CDC, 1985).

EPA attempts to provide some justification for its wholesale adoption of CDC's values by stating that the use of this range is only an interim measure. Additional guidance is to be provided by the Agency after it has finalized its reviews of development of a Cancer Potency Factor (CPF) or a Reference Dose (RfD) for lead. While recently evolving data on the health impacts of lead certainly merit systematic review by EPA (e.g., toxicity factor development processes), the failure to have completed these reviews does not justify proposal of soil cleanup levels which neither have a well-documented technical support nor acknowledge the substantial technically-based guidance alternatives which are currently available. These include use of the IU/BK model together with exposure and site-specific

considerations in identifying populations of primary concern and levels of exposure and risk. Such information has already undergone extensive review and compilation by several EPA offices as well as other Federal agencies (U.S. EPA, 1989a, 1989b, 1986; U.S. DHHS, 1988, 1985).

These factors, and their appropriate application in developing soil cleanup levels, are discussed in Comment 3 below. It should also be noted that, as acknowledged by EPA's Clean Air Scientific Advisory Committee (CASAC) Joint Lead Group meeting of April 27-28, 1989, the data base for neurological effects on children is vastly more extensive than that for lead carcinogenicity. Thus, even if quantification of carcinogenic potency for lead indicates comparable exposure levels of concern, neurological endpoints are likely to remain the primary focus of concern at sites where children may be exposed to lead contaminated soils.

- 2 EPA's application of CDC's soil lead values for use as cleanup levels is both technically deficient and extends the use of these values well beyond the uses intended by CDC.

As noted above, EPA does not provide documentation of the scientific rationale for the soil cleanup levels announced in its September 7, 1989 directive, but instead claims that the guidance adopts a "recommendation" generated by the CDC. The section quoted by

EPA as a "recommendation," however, appears in the 1985 CDC document Preventing Lead Poisoning in Young Children, under the heading "Sources of Lead Exposure." Examination of the information provided in this document as well as contacts with CDC staff provides no indication that CDC either intended these levels to be interpreted as levels of concern for adverse health effects or as levels to be used in establishing site cleanup standards. In other words, CDC did not make a "recommendation" at all.

As quoted in EPA's directive, the CDC document specifically states that "...lead in soil and dust appears to be responsible for blood levels in children increasing above background levels when the concentration in the soil or dust exceeds 500 to 1,000 ppm." No indication is provided of the background level used or of any potential occurrence of adverse effects following exposure to soil or dust lead levels in this range. With no index to either the magnitude of increase in blood lead from exposure or to anticipated health effects of such exposures, the CDC statement is merely an observation of a statistical measure. It provides no indication that exposure to the stated range of soil and dust lead levels will result in blood lead levels of health significance.

In addition, CDC provides no documentation of the derivation of their statement that blood lead levels increase with soil lead levels greater than 500-1,000 ppm. In personal communication, CDC staff indicated that the statement was intentionally not referenced. Instead, the committee preparing the CDC document provided this statement merely as

a reflection of professional judgment regarding the impacts of soil and dust lead on blood lead. The committee never intended for the information provided to be used as a regulation.

It should also be noted that background blood lead levels in the U.S. have decreased since the time at which the CDC report was issued. As outlined in Appendix C of the OAQPS Staff Report on lead (U.S. EPA 1989a), sources of lead that contribute to background levels of blood lead in the population have been decreasing since at least 1978. The changes that have been observed are partly due to the phase-down in use of leaded gasoline. This phase-down has been paralleled by a decline in blood lead levels, which is anticipated to continue into the 1990s. Similarly, dietary intake of lead has been decreasing since the late 1970s, and should continue to decrease as atmospheric deposition of lead onto foods, use of lead-soldered cans, and drinking water levels of lead all continue to decline. With the impact of these changes, EPA estimates that the 1990 baseline average blood lead levels for two year old children will be 28 to 35 percent of the baseline in 1978.

These changes in background levels would alter the significance of CDC's statement in terms of the blood lead levels which would result from exposures to soil and dust with lead concentrations of 500-1,000 ppm as well as in terms of the health impacts which might be expected. Since, as discussed above, no documentation is provided by CDC for blood

lead levels or anticipated health effects, the impacts of changes in background blood lead levels on their view of these soil/dust concentrations is difficult to assess.

Another difference between the CDC derivation of the soil lead concentration of concern and EPA's intended use of this range is the types of sites, and thus the types of lead, involved. CDC's review focused mainly on smelter sites and sites with typical urban lead exposures, including lead-based paints. The site cleanup levels will be applied to CERCLA sites, including mining sites. As discussed in Comment 3 below, evidence exists indicating differential absorption of lead derived from different sources. Variations in outdoor/indoor transfer of lead for different site types may also influence application of the CDC range to CERCLA sites as the CDC evaluation looked at soil and dust exposures together, without segregating their individual effects. These factor may further increase the inappropriateness of EPA's adoption of the CDC values.

The EPA directive, in adopting the CDC soil range for cleanups at hazardous waste sites, clearly has extended the use of these values well beyond their original intended purpose. Differences between the types of sites reviewed by CDC and those for which cleanup levels would be applied, as well as changes in background blood lead levels since the time of derivation of CDC's values, were not acknowledged by the Agency. Most importantly, EPA failed to provide a scientific basis for application of these values or to link exposures in excess of the suggested levels with adverse health effects.

- 3 EPA's soil cleanup levels fail to incorporate available modeling procedures and toxicological and site-specific data which must be considered in developing soil cleanup levels for lead-contaminated sites.

3.1 Exposure Considerations in Setting Soil Cleanup Levels

As noted above, EPA's guidance fails to identify the population to be protected by the stated cleanup levels. For residential settings, the stated setting of concern in the September 7 guidance, young children have been the primary population at risk due to exposure to lead-contaminated soils. This is due to their increased susceptibility to the neurological effects of lead (as compared to adults) as well as the likelihood of their greater exposure to lead, especially via soil ingestion.

Recently, increasing concern has been expressed over neurological impacts observed following prenatal exposures to lead at blood lead levels (10-15 $\mu\text{g/dl}$) which are lower than those previously thought to be acceptable for postnatal exposures for young children (25 $\mu\text{g/dl}$). While such impacts may exist, it must be recognized that the exposure pathway for fetuses from lead-contaminated soils is substantially different from that for young children. Specifically, while young children may directly ingest lead-contaminated soils, fetuses are only exposed to lead-contaminated soils via maternal ingestion and contact. Because young children are known to have enhanced soil ingestion rates as well as higher

lead absorption and retention rates compared to older children and adults, fetal exposures (via maternal exposures) to lead-contaminated soils will be much less than young child exposures. It is likely that the difference in magnitude of exposures may more than account for any difference in susceptibility to lead exposures (as indicated by blood lead levels) that may exist between fetuses and young children. By ignoring these factors, EPA has failed to develop soil cleanup criteria for lead-contaminated sites based on a consistent description of exposed populations of concern, exposure pathways, and acceptable exposure criteria.

3.2 Appropriate Use of Uptake Factors and Models in Setting Soil Cleanup Levels

In setting the current soil cleanup levels, EPA has dismissed the use of biokinetic uptake models, stating that such models may only be used where extensive environmental and biological data are available. This approach disregards the important contributions that such models can make towards understanding the interrelationships between environmental exposures, human body burden, and health impacts. It is also inconsistent with efforts being made in other parts of the Agency as well as by other groups. For example, in proposing a Maximum Contaminant Level (MCL) for lead in drinking water, EPA's Office of Drinking Water applied an uptake factor relating lead intake via water to blood lead levels (U.S. EPA, 1988). Similarly, the Task Force of the Society of Environmental

Geochemistry and Health is developing a methodology for establishing soil cleanup levels which incorporates information on the relationship between soil lead and blood lead (Wixson, 1989).

One of the most intensively evaluated models of this type is the Integrated Uptake/Biokinetic Model (IU/BK), which quantifies the relationship between environmental (i.e., air, dust/soil) and dietary lead levels and the associated blood lead levels. This model was selected by the U.S. EPA Office of Air Quality Planning and Standards (OAQPS) as a regulatory tool in setting a National Ambient Air Quality Standard (NAAQS) for lead. For this standard setting process, OAQPS is using the model to predict blood lead concentrations in children under different exposure conditions (U.S. EPA, 1989a).

The uptake portion of the model, developed by Kneip et al. (1983), accepts site-specific data or default values for lead levels in each medium and combines this information with assumptions regarding behavioral and physiological parameters (i.e., time spent indoors and outdoors, time spent sleeping, diet, dust/soil ingestion rates, daily breathing volumes, deposition efficiency in the respiratory tract, and absorption efficiency in the respiratory tract and gastrointestinal tracts (U.S. EPA, 1989b)). The biokinetic portion of the model (Harley and Kneip, 1985) accepts uptake predictions and computes age-specific blood lead levels based on a six-compartment biokinetic model of tissue distribution and excretion of lead (U.S. EPA, 1989b). Overall, the IU/BK model is very versatile in that the default

assumptions and values on which uptake rate and blood lead calculations are based can be replaced with available site-specific data or revised defaults. Thus, the model can be updated as new information on exposure levels, intake and uptake parameters become available.

To apply the model, a baseline blood lead level representing routine exposures to lead in food, air, and water is compiled. Then, the contributions to blood lead from exposure to housedust and soil are added to the baseline. The IU/BK model is then used to calculate mean blood levels by multiplying estimated lead input rates (in $\mu\text{g/day}$) by age-specific biokinetic slope factors (BSF, in $\mu\text{g/dL per } \mu\text{g/day}$). The mean blood lead levels can then be used to estimate the frequency distribution, a useful parameter for risk assessment purposes, for lead levels in populations of children (U.S. EPA, 1989b).

The results of several validation exercises conducted by the U.S. EPA for the IU/BK model (Figures 1 and 2) indicate that the model accurately predicts mean blood lead levels and population distributions associated with multimedia exposures in children (U.S. EPA, 1989a). These analyses assume a soil ingestion rate of 80-135 mg/day and 25% gastrointestinal absorption of lead from soil. Figure 1 shows that when site-specific data for air, dust, and soil lead were used in the model, predicted and observed mean blood lead levels and distributions were essentially identical. Figure 2 shows that when default

estimates of dust and soil lead were used in the model, predicted mean blood lead levels were within 2% of observed.

The Lead Exposure Subcommittee of the Clean Air Scientific Advisory Committee (CASAC) has "unanimously" agreed that the OAQPS document, "Review of the National Ambient Air Quality Standards for Lead: Exposure Analysis Methodology and Validation" (U.S. EPA, 1989a, which describes the IU/BK model) is scientifically adequate for use in the standard setting process for lead as an ambient air pollutant. The CASAC endorsed the opinion of its subcommittee in a recent letter addressed to U.S. EPA Administrator William Reilly (U.S. EPA, 1989a).

In addition, the recent "Technical Support Document on Lead" (U.S. EPA, 1989b), prepared by the U.S. EPA Office of Health and Environmental Assessment, stated that the IU/BK model "provides a useful and versatile method for exploring the potential impact of future regulatory decisions regarding lead levels in air, diet, and soil." The authors observe that the use of the IU/BK model has revealed that dust and soil ingestion are the largest sources of lead exposure in 2-year-old children in areas near a lead point source in which air lead levels are typical for urban areas in the United States.

In its September 7 directive, EPA implies that models such as the IU/BK may only be used where extensive, long-term environmental and biological data are available for a site. The

Agency also states that blood lead testing should not be the "sole criterion for evaluating the need for long-term remedial action at sites that do not already have an extensive, long-term blood-lead data base." While long-term data are clearly desirable, their absence or incompleteness should not totally preclude use of models such as the IU/BK. Indeed, it seems that if the Agency is concerned about remedial action decision-making in the face of limited data, it should encourage the use of models such as the IU/BK. In particular, to the extent that any blood lead data are available, they could be used to validate the assumptions used in the IU/BK model. The empirical data and modeling results together would provide insights into the site-specific relationships between soil concentrations and blood lead levels, yielding a stronger base for assessing appropriate soil cleanup levels.

In summary, the advantages to using the IU/BK model for establishing soil guidelines are that the model: incorporates flexibility in approaches to regulating exposures to lead, allows for the use of the most current site-specific data, results in the prediction of population distributions of blood lead concentrations, can provide a stronger basis for evaluating site-specific relationships between environmental concentrations and blood lead levels, and is consistent with derivation of the NAAQS and MCL for lead, as well as approaches to assessing lead toxicity undertaken by other groups.

3.3 Consideration of Differences in Bioavailability and Outdoor/Indoor Transfer of Lead from Different Sources

In the case of lead, most information on the relationship between blood lead and lead in soils is derived from studies conducted in urban communities or communities with operating smelters. As discussed above, based largely on these types of studies, the U.S. Centers for Disease Control (CDC) has suggested that when soil lead concentrations exceed 500-1,000 ppm, children's blood lead levels may increase above background levels (U.S. DHHS, 1985). The current literature suggests, however, that children living in mining towns without a recent history of smelting activities do not suffer from elevated blood lead concentrations. Particle size, lead species, and soil characteristics appear to be the primary factors behind this noted difference in impacts of soil lead from mining versus smelter sites on blood lead levels in children (Chaney, 1988). These factors appear to influence lead bioavailability and patterns of lead transport and exposure.

Studies have shown that dissolution of lead in the gut is a function of the surface-to-mass ratio associated with particle size (Steele et al., 1989; Healy et al., 1982; Barltrop and Meek, 1979). The larger the particle size, the smaller the relative surface area, and the lower the bioavailability. The influence of particle size on intestinal absorption was found to be especially important with particles < 100 μm in diameter (Barltrop and Meek, 1979). The particle sizes of a variety of tailings materials from different ores have been measured

in the range of 10 to 1,000 μm with none smaller than 1 μm (Andrews, 1975). In contrast, primary particles emitted from smelters fall in the 1 to 3 μm size range, with a significant number of particles smaller than 1 μm (Perera and Ahmed, 1979).

Lead species is another critical factor in determining bioavailability. For example, animal toxicology studies show that some lead species are absorbed to a lesser extent than others. Lead sulfide is significantly less absorbed than lead acetate and lead oxides (Barltrop and Meek, 1975). Sampling data have demonstrated that mine waste lead is mostly in the form of lead sulfide, a species of lower availability. By contrast, most lead in street dust is in the sulfate, halide, or oxide forms (Duggan and Williams, 1977).

Another factor which appears to reduce the bioavailability of lead in mine waste is the binding effect of the surrounding soils and rock matrix. The natural binding effect of lead in soils is enhanced in the case of mine waste or galena tailings, by the rock matrix surrounding the residual lead. In galena, the lead sulfide is embedded in a rock matrix, typically quartz. This rock matrix appears to reduce significantly the lead that is available for dissolution in the stomach (Bornschein, 1988). For example, recent reviews of the impact of soils on the bioavailability of lead (Steele et al., 1989; Chaney et al., 1988) have shown that while powdered lead sulfide is essentially as available as more soluble forms of lead, lead sulfide is likely to be much less bioavailable when found in mining wastes.

The transfer of lead in soils to housedust has also been observed to vary according to the source of the lead, yielding different exposure patterns. For example, in urban settings or areas with operating smelters, indoor dust concentrations were similar to soil concentrations (U.S. EPA, 1986). In mining studies, however, indoor dust concentrations were less than soil concentrations, varying from about 15 to 45% of the soil concentration when soil concentrations were greater than about 500-1000 ppm (Barltrop, 1975; Barltrop, 1988; Davies et al., 1985). At lower soil concentrations, housedust concentrations were often similar to or greater than soil concentrations, probably reflecting the predominance of indoor sources of housedust lead (e.g., paint) at lower soil concentrations.

Possible reasons for lower housedust lead concentrations in mining communities include the fact that in urban communities and/or communities with operating smelters, lead from deposition of airborne lead is more pervasive on soil surfaces, and thus is more available to be tracked into homes. In addition, airborne lead can penetrate buildings and contribute to housedust lead concentrations in this manner. Such differences are due in part to particle size. In particular, the particle size of mine wastes is sufficiently large that airborne particles from a mine waste source tend to settle out quickly and do not deposit in as broad an area as the smaller aerosols from stack air emissions, which stay airborne longer and travel farther (Davies and Wixson, 1985; Lagerweff and Brower, 1975). Larger particles are also less likely to enter homes and thus to contribute to house dust concentrations of lead.

In summary, in establishing soil guidelines for a contaminant, site-specific and contaminant-specific characteristics must be considered. The source and type of lead present at a specific site can influence both its bioavailability and its distribution in the environment, and resulting human exposures. Such factors would strongly influence development of appropriate cleanup levels.

3.4 Consideration of Site-Specific Issues

As acknowledged by EPA, site-specific considerations may require derivation of different soil cleanup levels than those proposed by the Agency. If the approaches suggested above were adopted, it is not clear that any generic cleanup levels would be either necessary or appropriate. Site-specific factors to be considered would include the form of lead present at a site (e.g., lead from mining activities versus lead from smelting activities with impacts as described above) and characteristics of the surrounding population (e.g., its proximity and demographics).

Although the current interim guidance is described as being appropriate for "residential settings", other types of sites (e.g., industrial, commercial, or agricultural) may also require establishment of soil cleanup levels. Other site uses (either current or future) would necessitate different considerations in setting cleanup levels, such as different population

subgroups of primary concern, different exposure pathways of concern, or different durations of exposure to site contamination. For example, children are unlikely to have much if any exposure to lead-contaminated soils at industrial sites. Thus, a different population subgroup, such as workers, is likely to be of primary concern for these sites. Childhood exposure to commercial sites would be determined in part by their proximity to residential areas, and would occur to a lesser extent than residential exposures. For non-agricultural rural lands (for example, parks, open space), risk would need to be determined in much the same way as for commercial property. Food chain exposures are likely to be of primary concern for agricultural lands. Adoption of procedures which allow for easier incorporation of these considerations into soil cleanup level derivation would result in cleanup standards which better reflect actual risks.

Conclusions

In summary, EPA's interim guidance provides inadequate documentation of the rationale and bases for the soil lead guidance levels proposed by the Agency. Their guidance neither uses the CDC soil values as intended by CDC nor acknowledges the substantial technical database available for setting soil lead cleanup levels. This lack of basis for their guidance levels casts doubt on the validity of the values proposed by EPA and provides

no clear method for incorporating site-specific considerations into the setting of soil cleanup levels for specific lead-contaminated sites.

The generic values proposed by EPA should be replaced by a systematic process which incorporates the substantial amount of information which is available on lead toxicity, uptake, and body burden. This process would include use of the IU/BK model (or similar models incorporating information on the relationships between environmental and body burden concentrations of lead, such as that under development by SEGH) as well as consideration of such critical factors as the bioavailability of different forms of lead. The population of concern, target blood lead levels, and the fraction of the population to be protected by the soil cleanup levels should also be specified in a consistent way. Such an approach would both provide a scientifically valid basis for deriving soil cleanup levels and would allow for incorporation of site-specific and other considerations. The type of results generated by this approach would also assist in understanding more clearly the impacts of proposed remedies on reducing risks from lead exposure.

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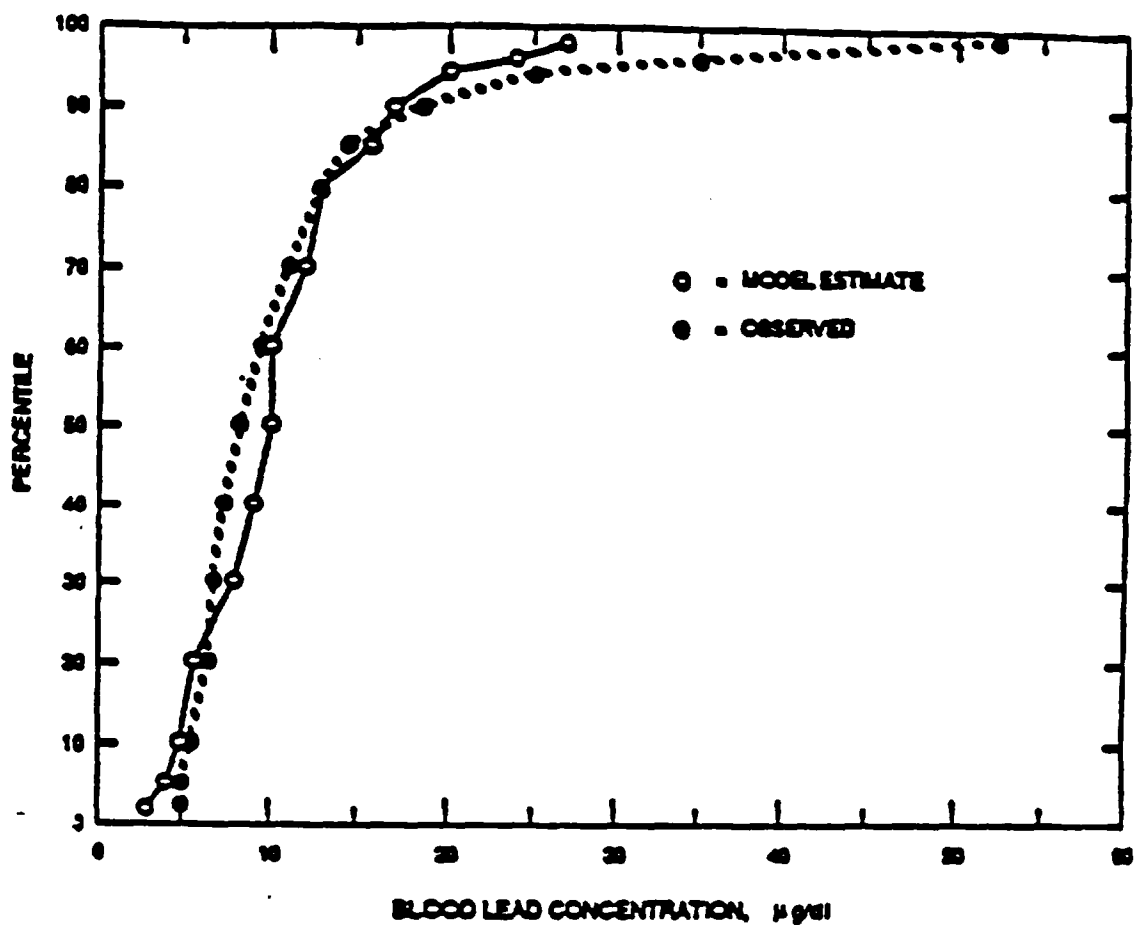


FIGURE 1

Comparison of Distribution of Measured Blood Lead Levels in Children, 1-5 Years of Age, Living Within 2.25 Miles of a Lead Smelter With Levels Predicted From the Uptake/Biokinetic Model. Measured Dust and Soil Lead Levels Were Included in the Input Parameters to the Model.

Source: U.S. EPA, 1989a

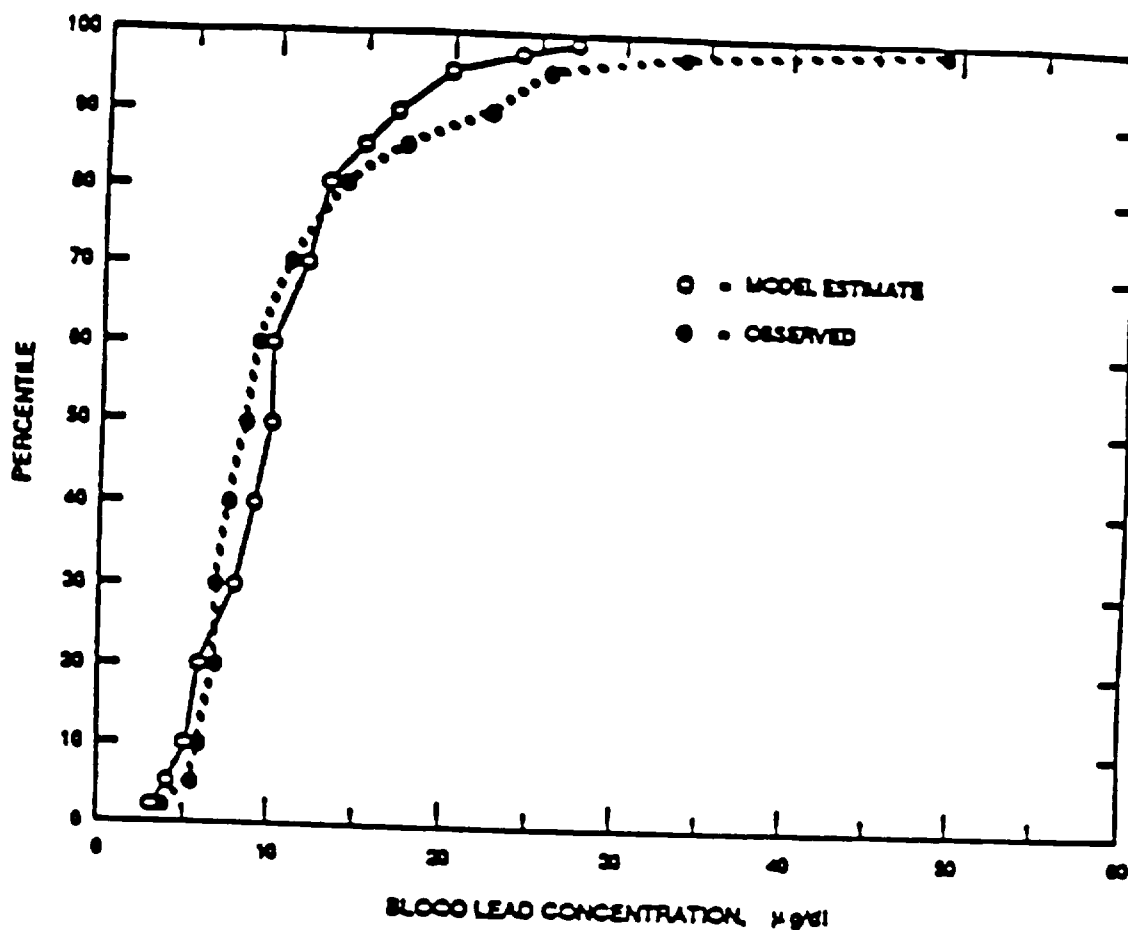


FIGURE 2

Comparison of Distribution of Measured Blood Lead Levels in Children, 1-5 Years of Age, Living Within 2.25 Miles of a Lead Smelter With Levels Predicted From the Uptake/Biokinetic Model. Dust and Soil Lead Levels Were Estimated Using Default Calculations.

Source: U.S. EPA, 1989a

EXHIBIT B

ALTERNATIVE H WORKSHEET

AREA 2			AREA 3			AREA 4			AREA 5			AREA 6			AREA 7			AREA 8S			AREA 8M		
Block	SF	CT	Block	SF	CT	Block	SF	CT	Block	SF	CT	Block	SF	CT	Block	SF	CT	Block	SF	CT	Block	SF	CT
1.0	0.0	0.0	28.0	107000.0	1981.6	33.0	54000.0	1900.0	105.0	108000.0	2000.0	98.0	144000.0	2666.7	107.0	168000.0	3111.1	11.0	0.0	0.0	49.0	0.0	0.0
2.0	0.0	0.0	29.0	114300.0	2116.8	34.0	72000.0	1333.3	T	108000.0	2000.0	99.0	144000.0	2666.7	T	168000.0	3111.1	12.0	0.0	0.0	50.0	90000.0	1666.7
3.0	36000.0	666.7	30.0	136200.0	2522.4	35.0	54000.0	1900.0	A	2.5	1000.0	100.0	144000.0	2666.7	A	3.9	1533.6	13.0	0.0	0.0	51.0	0.0	0.0
4.0	54000.0	1000.0	31.0	86400.0	1600.1	36.0	90000.0	1666.7	ST	12000.0		101.0	144000.0	2666.7	ST	18666.7		14.0	0.0	0.0	52.0	90000.0	1666.7
5.0	54000.0	1000.0	32.0	25200.0	466.7	37.0	108000.0	2000.0	PV	4000.0		103.0	144000.0	2666.7	PV	6222.2		15.0	0.0	0.0	53.0	90000.0	1666.7
6.0	18000.0	333.3	T	469100.0	8687.7	38.0	108000.0	2000.0	SB	8000.0		104.0	144000.0	2666.7	SB	12444.4		16.0	0.0	0.0	54.0	42600.0	788.9
7.0	18000.0	333.3	A	10.8		39.0	108000.0	2000.0				T	864000.0	16000.0				17.0	0.0	0.0	55.0	108000.0	2000.0
8.0	108000.0	2000.0	ST	52122.2		40.0	108000.0	2000.0				A	19.8	8000.0				18.0	0.0	0.0	56.0	33600.0	622.2
9.0	108000.0	2000.0	PV	17374.1		41.0	108000.0	2000.0				ST	96000.0					19.0	0.0	0.0	57.0	0.0	0.0
10.0	108000.0	2000.0	SB	34748.1		42.0	108000.0	2000.0				PV	32000.0					20.0	0.0	0.0	58.0	135000.0	2500.0
26.0	0.0	0.0				43.0	72000.0	1333.3				SB	64000.0					21.0	0.0	0.0	59.0	0.0	0.0
27.0	0.0	0.0				44.0	108000.0	2000.0										22.0	54000.0	1000.0	60.0	135000.0	2500.0
T	504000.0	9333.3				45.0	90000.0	1666.7										23.0	7100.0	131.5	61.0	162000.0	3000.0
A	11.6	4666.7				46.0	135000.0	2500.0										24.0	0.0	0.0	62.0	135000.0	2500.0
ST	56000.0					47.0	0.0	0.0										25.0	33600.0	622.2	63.0	135000.0	2500.0
PV	18666.7					48.0	105000.0	1944.4										44.0	0.0	0.0	64.0	54000.0	1000.0
SB	37333.3					49.0	105000.0	1944.4										45.0	54000.0	1000.0	65.0	135000.0	2500.0
						50.0	105000.0	1944.4										46.0	108000.0	2000.0	70.0	66600.0	1233.3
						51.0	0.0	0.0										48.0	0.0	0.0	71.0	0.0	0.0
						52.0	115200.0	2133.3										67.0	0.0	0.0	72.0	0.0	0.0
						53.0	115200.0	2133.3										68.0	81000.0	1500.0	73.0	0.0	0.0
						54.0	115200.0	2133.3										T	337700.0	6253.7	74.0	162000.0	3000.0
						55.0	108000.0	2000.0										A	7.8	3126.9	75.0	162000.0	3000.0
						56.0	108000.0	2000.0										ST	37522.2		76.0	162000.0	3000.0
						57.0	108000.0	2000.0										PV	12507.4		77.0	162000.0	3000.0
						58.0	108000.0	2000.0										SB	25014.8		78.0	162000.0	3000.0
						59.0	115200.0	2133.3													79.0	162000.0	3000.0
						60.0	115200.0	2133.3													80.0	135000.0	2500.0
						T	2646000.0	49000.0													81.0	0.0	0.0
						A	60.7	24500.0													106.0	0.0	0.0
						ST	294000.0														T	2518800.0	46644.4
						SB	196000.0														A	57.8	23322.2
						PV	98000.0														ST	279866.7	
																					PV	93288.9	
																					SB	186577.8	

SCALE

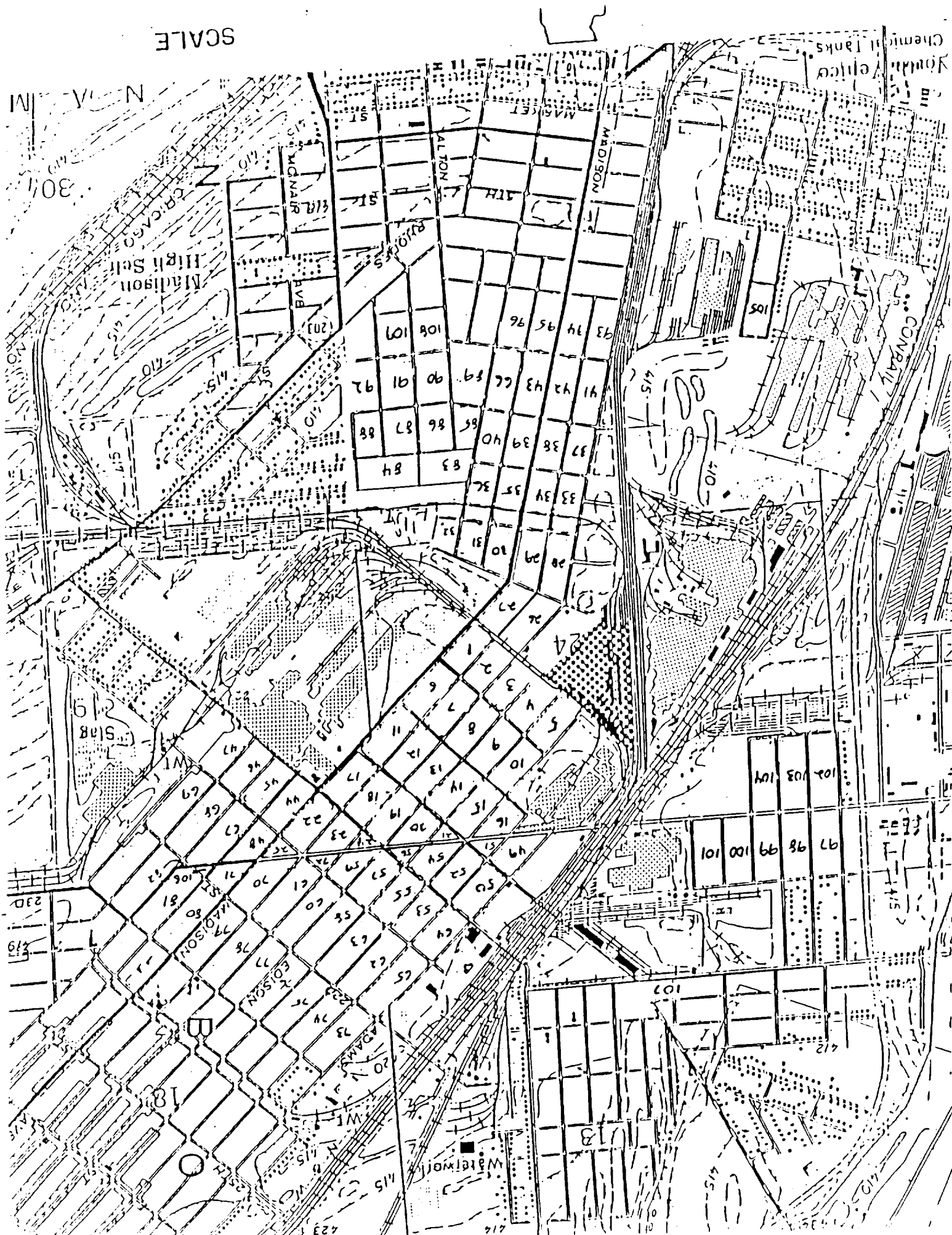


EXHIBIT B

City	Street	Sex	Age	FEP	BL
Granite City	2026 Cleveland	M	5	9	-
Granite City	2026 Cleveland	F	29	13	10
Granite City	900 Alton	F	2	21	5
Granite City	900 Alton	P	22	13	2
Granite City	1401 Iowa	P	5	13	8
Granite City	1401 Iowa	M	40	12	9
Granite City	1401 Iowa	F	33	20	6
Granite City	1710 Cleveland	M	2	16	23
Granite City	1710 Cleveland	M	4	15	21
Granite City	1710 Cleveland	F	27	43	28
Granite City	302S Buxton	F	1	1	6
Granite City	3025 Buxton	F	30	2	10
Granite City	3156 J111	M	1	13	5
Granite City	3156 J111	P	20	21	10
Granite City	2406 A State (Apt?)	M	6	24	8
Granite City	2406 A State (Apt?)	M	32	21	7
Granite City	1737 Olive	M	5	14	14-
Granite City	1737 Olive	F	31	17	9
Granite City	2341 Benton	M	5	24	20
Granite City	2341 Benton	P	30	21	12
Granite City	2502 State	M	5	18	8
Granite City	2502 State	P	26	28	8
Granite City	2919 Denver	M	39	17	21
Granite City	2919 Denver	M	2	49	5
Granite City	2132A Adams (Apt?)	M	4	9	3
Granite City	2132A Adams (Apt?)	F	1	10	5
Granite City	2132A Adams (Apt?)	F	Adult	10	5
Granite City	2132A Adams (Apt?)	M	30	9	10
Granite City	2443 State	F	30	30	5
Granite City	2443 State	F	1	21	5
Granite City	2436 Adams	M	4	8	6
Granite City	2436 Adams	F	27	22	8
Granite City	2641 Benton	M	3	18	6
Granite City	2691 Benton	P	34	19	6
Granite City	1742 Popular	P	2	31	11
Granite City	1742 Popular	M	5	13	11
Granite City	1739 Edison	P	4	13	10
Granite City	1739 Edison	P	3	45	15
Granite City	1739 Edison	F	20	13	2
Granite City	2618 Denver	F	5	12	14
Granite City	2618 Denver	P	25	19	8
Granite City	1634 Cleveland	F	5	9	14
Granite City	1634 Cleveland	F	23	10	11
Granite City	2145 Cleveland	M	3	19	19
Granite City	2145 Cleveland	F	23	18	-
Granite City	2152 State	M	4	11	32
Granite City	2152 State	F	24	11	11
Granite City	2158 State	M	4	10	4
Granite City	2158 State	F	29	21	10

City	Street	Sex	Age	FEP	BL
Granite City	2904 Harding	M	43	18	26
Granite City	2904 Harding	F	2	-	-
Granite City	2021 Dewey	M	2	18	22
Granite City	2021 Dewey	F	22	16	5
Granite City	2322 Delmar	F	3	12	14
Granite City	2322 Delmar	F	4	18	13
Granite City	2322 Delmar	F	32	19	15
Granite City	1619 Edison	F	6	18	24
Granite City	1619 Edison	F	30	20	15
Granite City	2159 Benton	M	4	6	10
Granite City	2159 Benton	F	-	13	11
Granite City	1442 Grand	F	4	13	30
Granite City	1442 Grand	P	30	15	7
Granite City	1443 Grand	F	38	10	9
Granite City	1443 Grand	M	4	20	37
Granite City	1103 Madison	M	1	8	11
Granite City	1103 Madison	F	27	10	3
Madison	1021 Grand (Apt)	F	3	76	28
Madison	1021 Grand (Apt)	M	4	30	27
Madison	1021 Grand (Apt)	P	13	11	8-
Madison	1021 Grand (Apt)	P	25	12	12
Madison	1207 Market	M	1	59	5
Madison	1207 Market	F	3	16	9
Madison	1207 Market	P	27	24	5
Madison	1109 Bissell	F(?)	1 ½	18	6
Madison	1109 Bissell	F	35	53	5
Madison	1109 Bissell	M	38	32	11
Madison	202 Logan	M	60	11	8
Madison	202 Logan	M	5	18	9
Madison	1034 Logan	F	5	16	14
Madison	1034 Logan	M	24	18	16
Madison	1034 Logan	M	54	19	22
Madison	1217 Market (rear)	P	24	25	2
Madison	1217 Market (rear)	F	5	23	8
Madison	713 Jackson	M	3	14	13
Madison	713 Jackson	F	29	15	3
Madison	213 Bissell	M	1	6	10
Madison	213 Bissell	F	18	11	16
Madison	403 W 3rd	F(?)	1	5	18
Madison	403 W 3rd	F	26	6	8
Madison	615 Meredocia	M	56	1	4
Madison	615 Meredocia	M	6	1	10
Madison	201 Weaver (Apt)	F	2	63	22
Madison	201 Weaver (Apt)	F	32	1	8
Madison	914 Grand	F	3	11	12
Madison	914 Grand	F	35	9	7
Madison	925 Iowa	F	26	7	-
Madison	925 Iowa	M	23	3	-
Madison	857 Alton	F	25	21	6
Madison	857 Alton	M	1	-	1
Madison	405 W 3rd	F	21	4	10
Madison	405 W 3rd	F	3	3	11

TABLE 1

Results - Granite City 1982 IDPH
Blood Lead Survey

Areas ¹	Number ²	FEP ³	P6B ⁴	Potential ⁵ Health Risk
2	6	16.8 (9-45)	17.1 (10-24)	0
3	2	16.1 (13-20)	33.5 (30-37)	0
4	6	19.5 (8-76)	15.8 (8-41)	2 6
5	1	1	10	0
6	3	17.8 (13-31)	11.9 (11-14)	0
7	2	28.8 (17-49)	8.4 (5-14)	0
8N	13	13.8 (6-24)	8.0 (3-32)	0
Total Granite City	13	14.1 (1-49)	10.4 (3-41)	0

1 Areas correspond to areas proposed by EPA for remediation in Figures 4-5.

2 Number of children age 1 to 6 years.

3 FEP - Geometric Mean (range), Free Erythrocyte (mg/dl).

4 P6B - Geometric Mean (range), Blood Lead (mg/dl).

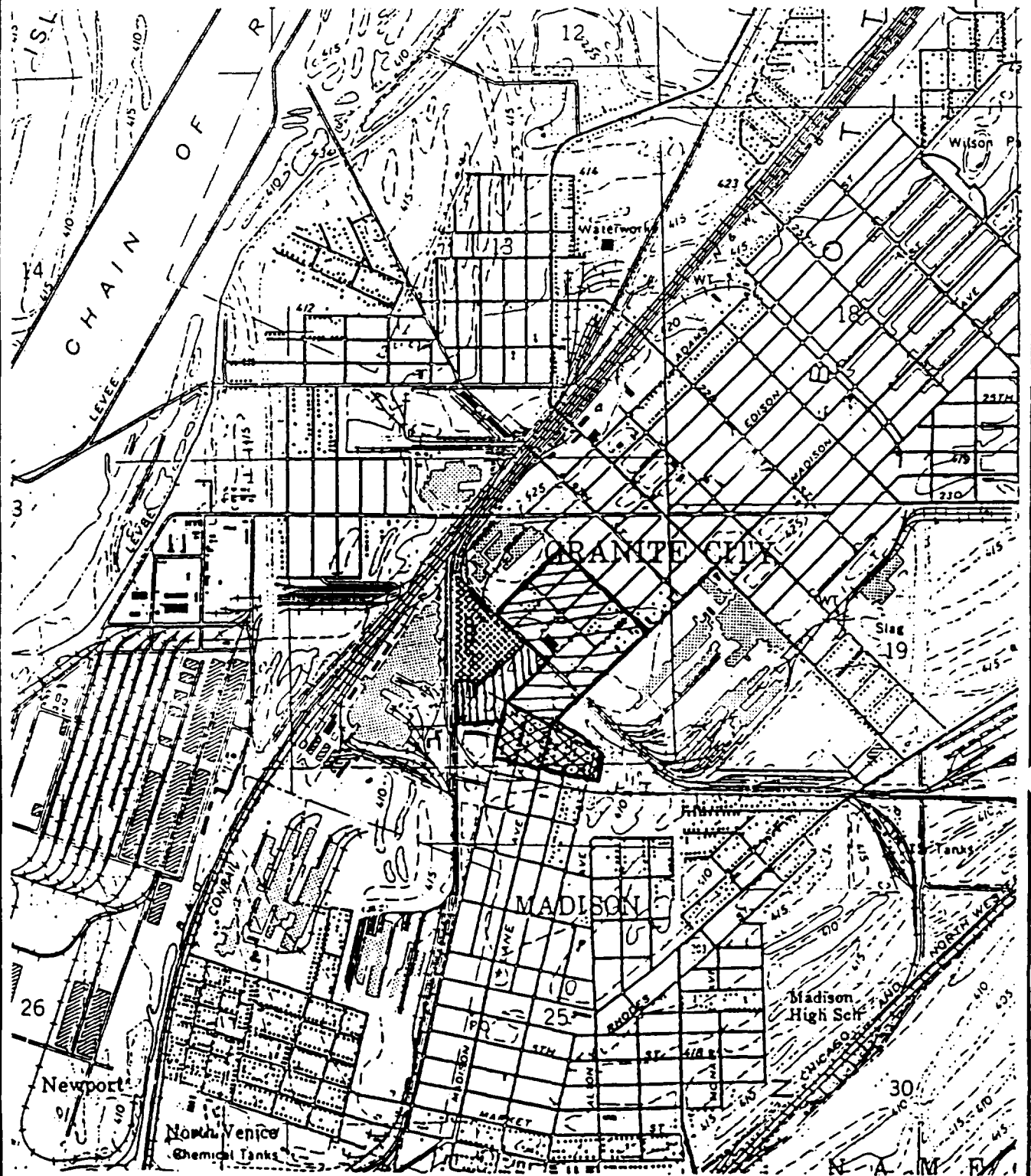
5 CDC action level of both FEP > 35 mg/dl and P6B > 15.

6 Area 4 levels are believed to be from a source other than soil lead.

Figure 4

HL INDUSTRIES
GRANITE CITY SITE
GRANITE CITY, ILLINOIS

Areas 1, 2, and 3



- PROJECT SITE
- Area 2
- Area 1
- Area 3

NOTE: MAP ADAPTED FROM U.S.G.S.
GRANITE CITY QUADRANGLE

QUADRANGLE LOCATION



SCALE

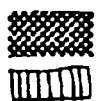
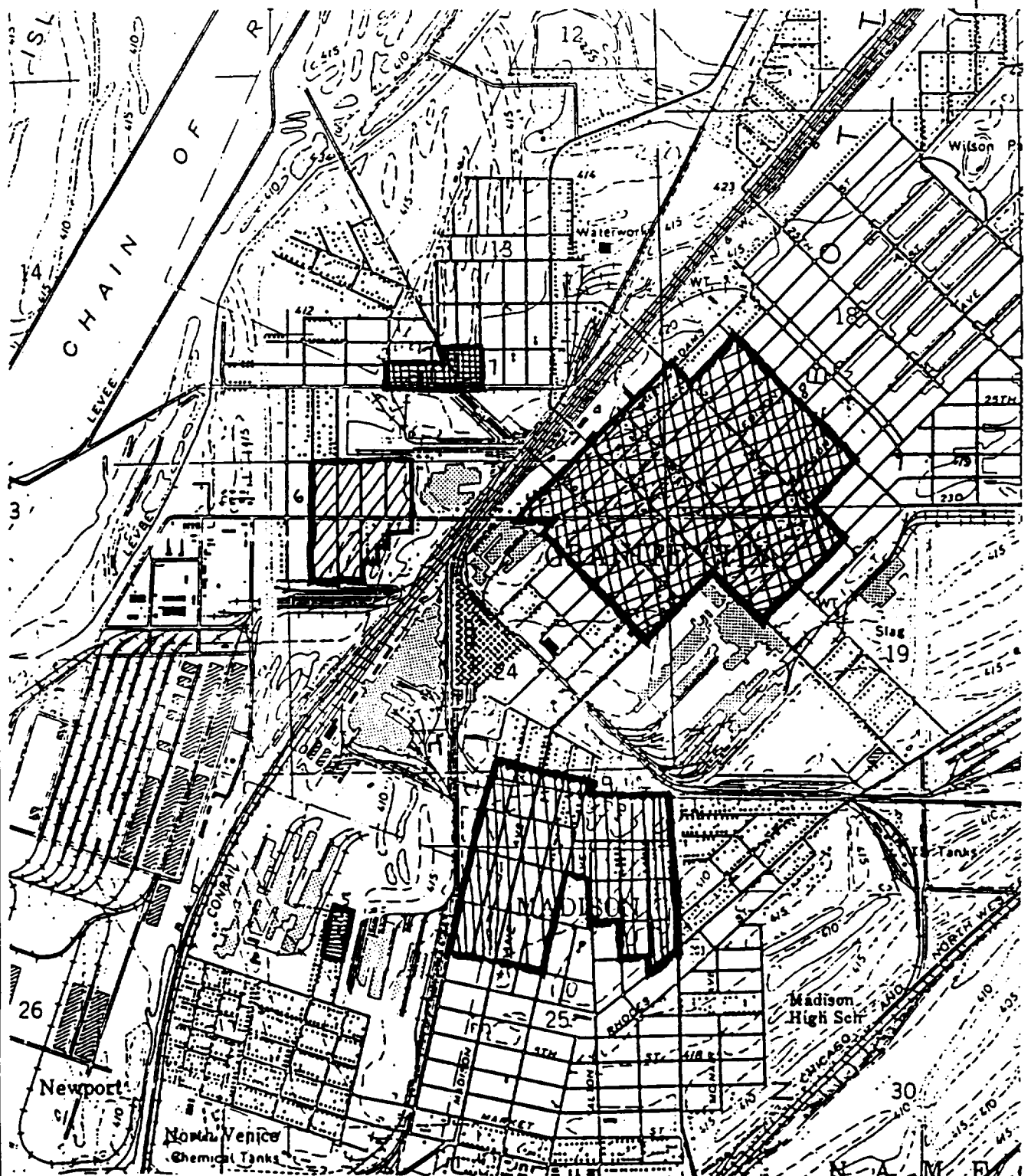


MILES

Figure 5

GRANITE CITY SITE
GRANITE CITY, ILLINOIS

Areas 4, 5, 6, 7, and 8



- PROJECT SITE

- Area 5

- Area 7

SCALE

- Area 4

- Area 6

- Area 8

NOTE: MAP ADAPTED FROM U.S.G.S.
GRANITE CITY QUADRANGLE

QUADRANGLE LOCATION

MILES



Memorandum

To: Files
From: J.M. O'Loughlin *g (51)*
Subject: NL Granite City Materials Cost Estimates

Date: 17 July 1989
File: 2844.012
Copies: F.D. Hale
D.G. Coleman
K. Lamb

1. Topsoil

a.	Litton Excavating (314) 781-6060	\$65.00/7 CY
b.	Kurtz Nursery & Topsoil (314) 946-9191	\$79.00/7 CY
c.	Dixon Topsoil Co. (314) 843-0134	\$70.00/7 CY

Average: \$10.00/CY delivered to St. Louis metro area. Sources contacted had adequate quantities available

2. Sand/Gravel

	Sand	Gravel
a. Riverview Quarry (314) 837-3511	\$3.35/ton	\$4.40/ton
b. St. Charles Quarry (314) 946-0004	\$4.45/ton	\$5.00/ton

Average: \$3.90/ton sand, \$4.70/ton gravel, not delivered.

Assume \$3.30/loaded mile, 15 mile haul, 16 CY truck.

Sand 1.5 ton/yd. Gravel 1.0 ton/yd.

Sand delivered: \$9.00/CY

Gravel delivered: \$8.00/CY

3. Clay

a. St. Charles Quarry
7921 Alabama Road
St. Louis, MO 63111

- POC: Darrel Emge (314) 544-4444 (main office)
(314) 946-0004 (quarry)
- several thousand tons currently available for cost of load and haul.
estimate \$7/CY load and haul to Granite City

NOTE: Clay pits, perse, do not exist in St. Louis area (Kevin Lamb, Darrel Emge). Clay generally available as a result of construction excavation, quarry excavation.

4. Summary:

Topsoil:	\$10.00/CY delivered
Sand:	\$ 9.00/CY delivered
Gravel:	\$ 8.00/CY delivered
Clay:	\$ 7.00/CY delivered

These cost estimates are based on Missouri sources, many of which are not licensed to truck to Illinois. Although better defined estimates would be based on Illinois sources, these costs should be fairly representative of material costs in that part of the country.

These costs compare favorably to Kevin Lamb's (St. Louis office) estimates of \$10-\$11/CY topsoil delivered and \$7/CY clay delivered.



OBRIEN & GERE

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Date: 17 July 1989
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Copies: F.D. Hale
D.G. Coleman
K. Lamb

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b.	St. Charles Quarry (314) 946-0004	\$4.45/ton
		\$5.00/ton

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Assume \$3.30/loaded mile, 15 mile haul, 16 CY truck.

Sand 1.5 ton/yd. Gravel 1.0 ton/yd.

Sand delivered: \$9.00/CY

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TABLE 17
NL GRANITE CITY
PRELIMINARY COST ESTIMATE
ALTERNATIVE H

	QUANTITY	UNITS	UNIT COST	EXTENDED COST	TOTAL COST
TARACORP PILE MULTIMEDIA CAP					
Grading/contouring/consolidation	44,440	SY	\$3	\$133,320	
Buy/haul/place 24" clay	29,630	CY	\$20	\$592,600	
Buy/place 40-mil synthetic cover	400,000	SF	\$1	\$400,000	
Buy/haul/place 6" gravel	7,400	CY	\$15	\$111,000	
Buy/haul/place Geotextile filter fabric	400,000	SF	\$0.2	\$80,000	
Buy/haul/place 6" embankment	7,400	CY	\$10	\$74,000	
Buy/haul/place 6" topsoil	7,400	CY	\$20	\$148,000	
Seed, fertilizer, mulch	44,440	SY	\$1	\$44,440	
Fencing	3,000	FT	10	\$30,000	
SUBTOTAL				\$1,613,360	\$1,613,360
CONTAINED DROSSES					
Loading (Crane & Crew)	LS	LS	\$800	\$800	
Transport to secondary smelter (600 miles @ \$3.50/loaded mile)	1	Load	\$2,100	\$2,100	
Smelting (adjusted for recovery)	12	Ton	300	\$3,600	
SUBTOTAL				\$6,500	\$6,500
SLLR PILES					
Excavation	3,920	CY	\$25	\$98,000	
Transport to Taracorp Pile	3,920	CY	\$3	\$11,760	
SUBTOTAL				\$109,760	\$109,760
VENICE ALLEYS EXCAVATE AND RESTORE					
Clear/replace incidentals	1.6	Acres	\$5,000	\$8,000	
Excavate to depth of 3"	670	CY	\$30	\$20,100	
Load and transport to Taracorp Pile	670	CY	\$6	\$4,020	
Grade and apply base course	5,300	SY	\$3	\$15,900	
Buy/haul/place asphalt	5,300	SY	\$8	\$42,400	
Buy/haul/place 3" topsoil	225	CY	\$25	\$5,625	
Buy/haul/place sod	2,700	SY	\$4	\$10,800	
SUBTOTAL				\$106,845	\$106,845
EAGLE PARK EXCAVATE AND RESTORE					
Clear	.5	Acres	\$3,000	\$1,500	
Manual excavation	100	CY	\$60	\$6,000	
Light equipment excavation	500	CY	\$30	\$15,000	
Heavy equipment excavation	2,100	CY	\$20	\$42,000	
Load and transport to Taracorp Pile	2,700	CY	\$6	\$16,200	
Buy/haul/place backfill	2,500	CY	\$10	\$25,000	
Buy/haul/place 3" topsoil	200	CY	\$20	\$4,000	
Buy/haul/place sod	2,200	SY	\$4	\$8,880	
SUBTOTAL				\$118,580	\$118,580

TABLE 17
NL GRANITE CITY
PRELIMINARY COST ESTIMATE
ALTERNATIVE II

	QUANTITY	UNITS	UNIT COST	EXTENDED COST	TOTAL COST

AREA 1 EXCAVATE AND RESTORE					
Clear/Replace Incidentals	13.5	ACRES	\$5,000	\$67,500	
Manual Excavation	465	CY	\$60	\$27,900	
Light Equipment Excavation	7,890	CY	\$30	\$236,700	
Heavy Equipment Excavation	7,890	CY	\$20	\$157,800	
Load and Transport to Taracorp Pile	16,245	CY	\$6	\$97,470	
Grade and apply pavement base course	27,200	SY	\$3	\$81,600	
Buy/haul/place asphalt	27,200	SY	\$8	\$217,600	
Buy/haul/place topsoil	9,450	CY	\$20	\$189,000	
Buy/haul/place sod	37,780	SY	\$4	\$151,120	
Buy/haul/place shrubs	10	EA	\$50	\$500	
Buy/haul/place trees	5	EA	\$200	\$1,000	
SUBTOTAL				\$1,228,190	\$1,228,190
AREA 2 EXCAVATE AND RESTORE					
Clear/Replace Incidentals	11.6	ACRES	\$5,000	\$58,000	
Manual Excavation	4,667	CY	\$60	\$280,020	
Light Equipment Excavation	4,667	CY	\$30	\$140,010	
Heavy Equipment Excavation	0	CY	\$20	\$0	
Load and Transport to Taracorp Pile	9,334	CY	\$6	\$56,004	
Grade and apply pavement base course	23,770	SY	\$3	\$71,310	
Buy/haul/place asphalt	23,770	SY	\$8	\$190,160	
Buy/haul/place topsoil	5,372	CY	\$35	\$188,020	
Buy/haul/place sod	32,230	SY	\$4	\$128,920	
Buy/haul/place shrubs	150	EA	\$50	\$7,500	
Buy/haul/place trees	70	EA	\$200	\$14,000	
SUBTOTAL				\$1,133,944	\$1,133,944
AREA 3 EXCAVATE AND RESTORE					
Clear/Replace Incidentals	10.8	ACRES	\$5,000	\$54,000	
Manual Excavation	4,344	CY	\$60	\$260,640	
Light Equipment Excavation	4,344	CY	\$30	\$130,320	
Heavy Equipment Excavation	0	CY	\$20	\$0	
Load and Transport to Taracorp Pile	8,688	CY	\$6	\$52,128	
Grade and apply pavement base course	3,280	SY	\$3	\$9,840	
Buy/haul/place asphalt	3,280	SY	\$8	\$26,240	
Buy/haul/place topsoil	8,140	CY	\$35	\$284,900	
Buy/haul/place sod	48,840	SY	\$4	\$195,360	
Buy/haul/place shrubs	70	EA	\$50	\$3,500	
Buy/haul/place trees	30	EA	\$200	\$6,000	
SUBTOTAL				\$1,022,928	\$1,022,928

TABLE 17
NL GRANITE CITY
PRELIMINARY COST ESTIMATE
ALTERNATIVE II

	QUANTITY	UNITS	UNIT COST	EXTENDED COST	TOTAL COST
AREA 4 EXCAVATE AND RESTORE					
Clear/Replace Incidentals	60.7	ACRES	\$5,000	\$303,500	
Manual Excavation	24,500	CY	\$60	\$1,470,000	
Light Equipment Excavation	24,500	CY	\$30	\$735,000	
Heavy Equipment Excavation	0	CY	\$20	\$0	
Load and Transport to Taracorp Pile	49,000	CY	\$6	\$294,000	
Grade and apply pavement base course	98,000	SY	\$3	\$294,000	
Buy/haul/place asphalt	98,000	SY	\$8	\$784,000	
Buy/haul/place topsoil	32,667	CY	\$35	\$1,143,345	
Buy/haul/place sod	196,000	SY	\$4	\$784,000	
Buy/haul/place shrubs	395	EA	\$50	\$19,750	
Buy/haul/place trees	170	EA	\$200	\$34,000	
SUBTOTAL				\$5,861,595	\$5,861,595
AREA 5 EXCAVATE AND RESTORE					
Clear/Replace Incidentals	2.5	ACRES	\$5,000	\$12,500	
Manual Excavation	1,000	CY	\$60	\$60,000	
Light Equipment Excavation	1,000	CY	\$30	\$30,000	
Heavy Equipment Excavation	0	CY	\$20	\$0	
Load and Transport to Taracorp Pile	2,000	CY	\$6	\$12,000	
Grade and apply pavement base course	4,000	SY	\$3	\$12,000	
Buy/haul/place asphalt	4,000	SY	\$8	\$32,000	
Buy/haul/place topsoil	1,333	CY	\$35	\$46,655	
Buy/haul/place sod	8,000	SY	\$4	\$32,000	
Buy/haul/place shrubs	16	EA	\$50	\$800	
Buy/haul/place trees	7	EA	\$200	\$1,400	
SUBTOTAL				\$239,355	\$239,355
AREA 6 EXCAVATE AND RESTORE					
Clear/Replace Incidentals	19.8	ACRES	\$5,000	\$99,000	
Manual Excavation	8,000	CY	\$60	\$480,000	
Light Equipment Excavation	8,000	CY	\$30	\$240,000	
Heavy Equipment Excavation	0	CY	\$20	\$0	
Load and Transport to Taracorp Pile	16,000	CY	\$6	\$96,000	
Grade and apply pavement base course	32,000	SY	\$3	\$96,000	
Buy/haul/place asphalt	32,000	SY	\$8	\$256,000	
Buy/haul/place topsoil	10,667	CY	\$35	\$373,345	
Buy/haul/place sod	64,000	SY	\$4	\$256,000	
Buy/haul/place shrubs	129	EA	\$50	\$6,450	
Buy/haul/place trees	55	EA	\$200	\$11,000	
SUBTOTAL				\$1,913,795	\$1,913,795

TABLE 17
NL GRANITE CITY
PRELIMINARY COST ESTIMATE
ALTERNATIVE II

	QUANTITY	UNITS	UNIT COST	EXTENDED COST	TOTAL COST

AREA 7 EXCAVATE AND RESTORE					
Clear/Replace Incidentals	3.9	ACRES	\$5,000	\$19,500	
Manual Excavation	1,556	CY	\$60	\$93,360	
Light Equipment Excavation	1,556	CY	\$30	\$46,680	
Heavy Equipment Excavation	0	CY	\$20	\$0	
Load and Transport to Taracorp Pile	3,112	CY	\$6	\$18,672	
Grade and apply pavement base course	6,222	SY	\$3	\$18,666	
Buy/haul/place asphalt	6,222	SY	\$8	\$49,776	
Buy/haul/place topsoil	2,074	CY	\$35	\$72,590	
Buy/haul/place sod	12,444	SY	\$4	\$49,776	
Buy/haul/place shrubs	25	EA	\$50	\$1,250	
Buy/haul/place trees	11	EA	\$200	\$2,200	
SUBTOTAL				\$372,470	\$372,470
AREA 8S EXCAVATE AND RESTORE					
Clear/Replace Incidentals	7.8	ACRES	\$5,000	\$39,000	
Manual Excavation	3,127	CY	\$60	\$187,620	
Light Equipment Excavation	3,127	CY	\$30	\$93,810	
Heavy Equipment Excavation	0	CY	\$20	\$0	
Load and Transport to Taracorp Pile	6,254	CY	\$6	\$37,524	
Grade and apply pavement base course	12,507	SY	\$3	\$37,521	
Buy/haul/place asphalt	12,507	SY	\$8	\$100,056	
Buy/haul/place topsoil	4,169	CY	\$35	\$145,915	
Buy/haul/place sod	25,015	SY	\$4	\$100,060	
Buy/haul/place shrubs	51	EA	\$50	\$2,550	
Buy/haul/place trees	22	EA	\$200	\$4,400	
SUBTOTAL				\$748,456	\$748,456
AREA 8N EXCAVATE AND RESTORE					
Clear/Replace Incidentals	57.8	ACRES	\$5,000	\$289,000	
Manual Excavation	23,322	CY	\$60	\$1,399,320	
Light Equipment Excavation	23,322	CY	\$30	\$699,660	
Heavy Equipment Excavation	0	CY	\$20	\$0	
Load and Transport to Taracorp Pile	46,644	CY	\$6	\$279,864	
Grade and apply pavement base course	93,289	SY	\$3	\$279,867	
Buy/haul/place asphalt	93,289	SY	\$8	\$746,312	
Buy/haul/place topsoil	31,096	CY	\$35	\$1,088,360	
Buy/haul/place sod	186,578	SY	\$4	\$746,312	
Buy/haul/place shrubs	376	EA	\$50	\$18,800	
Buy/haul/place trees	162	EA	\$200	\$32,400	
SUBTOTAL				\$5,579,895	\$5,579,895

TABLE 17
NL GRANITE CITY
PRELIMINARY COST ESTIMATE
ALTERNATIVE H

	QUANTITY	UNITS	UNIT COST	EXTENDED COST	TOTAL COST

OTHER COSTS					
Monitoring Well	90	LF	\$60	\$5,400	
Deed Restrictions	LS	LS	\$15,000	\$15,000	
Safety Program	LS	LS	\$40,000	\$40,000	
Mobilization	LS	LS	\$65,000	\$65,000	
Dust Control	LS	LS	\$40,000	\$40,000	
Equipment Decontamination	LS	LS	\$40,000	\$40,000	
Off-Site Drainage Control	LS	LS	\$25,000	\$25,000	
SUBTOTAL				\$230,400	\$230,400
ESTIMATED DIRECT CAPITAL COST					\$20,286,073
INDIRECT CAPITAL COSTS					
Contingency Allowance (25%)					\$5,071,518
Engineering Fees (15%)					\$3,042,911
Legal Fees (5%)					\$1,014,304
ESTIMATED INDIRECT CAPITAL COST					\$9,128,733
TOTAL ESTIMATED CAPITAL COST					\$29,414,806
ANNUAL OPERATING AND MAINTENANCE COSTS					
Air monitoring	2	Mandays	\$250	\$500	
Sample analysis	8	Samples	\$1,000	\$8,000	
Groundwater sample collection	8	Mandays	\$250	\$2,000	
Sample analysis	22	Samples	\$150	\$3,300	
Site mowing	26	Mandays	\$250	\$6,500	
Site inspection	8	Mandays	\$250	\$2,000	
Miscellaneous site work	36	Mandays	\$250	\$9,000	
Site work materials	LS	LS	\$4,000	\$4,000	
ESTIMATED ANNUAL O & M				\$35,300	
PRESENT WORTH OF ANNUAL O & M FOR 30 YEARS (I-5%)				\$542,630	\$542,630
ALTERNATIVE H ESTIMATED COST					\$29,957,436

ADDENDUM

The following additions and corrections should be made to Appendix B: Selection of a Lead Soil Clean-up Level for the NL/Taracorp Superfund Site.

- 1) Sixth page, last line. 500 micrograms per deciliter should read 500 ppm.
- 2) Eighth page, line 11. Reference 1989c should be 1989a.
- 3) Ninth page, line 9. Text should read: It is notable that at a lead in soil level of 500 ppm, the model shows that for most ages the soil/dust lead intake is approximately 15 micrograms per day. At a lead soil level of 1000 ppm, the soil/dust lead intake is greater than 29 micrograms per day, accounting for approximately 63 percent of the total daily intake. At both soil lead levels, the intakes from air and water are nonsignificant.

APPENDIX B

SELECTION OF A LEAD SOIL CLEAN-UP LEVEL FOR THE NL/TARACORP SUPERFUND SITE

Prepared by U.S. EPA, Region V

Several sets of comments to the Proposed Plan at the NL/Taracorp site have questioned U.S. EPA's decision regarding the selection of the lead in soil clean-up standards to be used at the site. This document is intended to respond to these comments by setting forth U.S. EPA rationale supporting this decision.

Lead poisoning in young children is one of the most prevalent and preventable childhood public health problems in the U.S. today (USDHHS, 1985). The Environmental Protection Agency's concern with the health hazards of lead is longstanding - The Clean Air Act of 1970 authorized the EPA to set National Ambient Air Quality Standards (NAAQS) for the regulation of air emissions of pollutants considered harmful to public health or welfare; lead was one of the six pollutants to be regulated. In 1974 under the regulatory requirements of the Safe Drinking Water Act, EPA Office of Drinking Water issued its National Interim Primary Drinking Water Regulations; again lead was one of the 26 contaminants addressed. Since 1975, EPA has increasingly restricted automobile emissions; all new cars since 1975 have been equipped with catalytic converters. Because lead destroys the effectiveness of these converters, the use of unleaded gasoline has increased dramatically, with corresponding decreases in lead emissions from exhaust. EPA has moved to accelerate this progress by phasing out lead in gasoline during the 1980s.

Further reductions in the National Ambient Air Quality Standard for lead and the Maximum Concentration Level for lead in drinking water are expected in 1990. The overall effect of these control programs has been a major reduction in the amount of lead being released to the environment.

Lead released into the environment in the past from stationary sources such as factories, power plants and smelters and from mobile sources such as automobiles, buses and other forms of transportation remains a persistent problem. Deposition and precipitation have resulted in the accumulation of high concentrations of lead in the soil in areas where significant releases to the air have occurred. Thus, lead-contaminated soils and housedust have emerged as important contributors to blood lead concentrations in the general population.

The present action has provided a mechanism for the clean-up of the lead in the soil at the NL/Taracorp Superfund site in Granite City. A risk assessment has been prepared by O'Brien & Gere as part of the Remedial Investigation for the NL/Taracorp Superfund site (Remedial Investigation Report 1988). This health risk assessment has correctly identified children as the most sensitive subpopulation, noting that they are at particular risk to lead poisoning due to their greater lead absorption efficiency than adults and to their greater probability of exposure to environmental lead in soil through outdoor play activities, mouthing habits and through intentional ingestion of soil (pica). It further identifies two pathways for lead exposure to the resident population stemming from the Superfund site as being complete: " 1) the airborne route, with lead-bearing soil particulates and dusts transported from friable soils on the Taracorp site to offsite locations

for subsequent inhalation, and 2) the direct contact route, with exposed soils previously contaminated with lead from particulate fallout from smelting emissions in previous years providing a source for ingestion of lead residues". Pathways have been identified as complete based on contaminant existence, magnitude, environmental fate, toxicological impacts of components released from the site and transport to receptors. The assessment also acknowledges that "lead in its various environmental forms is able to combine with a variety of physiologically significant proteins in the body, with resultant effects on structure and function".

Because children are developing, they absorb and retain more lead than adults. Thus, even at very low levels of lead exposure, children can experience reduced I.Q. levels, impaired learning and language skills, loss of hearing, and reduced attention spans and poor classroom performance. At higher levels, lead can damage their brains and central nervous systems, interfering with both learning and physical growth. Needleman (1988) has provided a review of 110 publications documenting the health effects of lead in children. He summarized that at low blood lead levels, neurocognitive effects of lead expressed as diminished psychometric intelligence, attention deficits, conduct problems, alterations in the electroencephalogram, school failure and increased referral rates for special needs predominant. He emphasizes that careful epidemiologic studies, which have controlled for the important confounders, have set the level for these effects at 10-15 micrograms per deciliter lead in blood. Exposure to lead in men can cause increases in blood pressure. These health effects and their associated blood lead levels have been summarized by EPA and the Agency for Toxic Substances and Disease Registry (ATSDR), and are summarized in Table 1. Particularly

notable are the risks of lead to women of child-bearing age. They include fertility problems and miscarriages. In pregnant women, lead can cause impaired development of the fetus, premature births and reduced birth weights. The data in Table 2 shows that miscarriages and reproductive effects, such as premature birth and low birth weight, may occur at blood lead levels as low as 10 micrograms per deciliters and possibly lower. It is this growing preponderance of literature that has prompted the National Centers for Disease Control (CDC) to consider the lowering of the blood lead level from 25 to 15 micrograms per deciliter to protect for the health effects seen at lower levels. It is also this same growing accumulation of evidence that has led EPA to reject the suggestion put forth by the contractors for NL Industries in their risk assessment that the proposed 15 micrograms per deciliter blood lead level can be considered as a threshold level for the adverse health effects of lead in children. This lack of ability to identify a threshold level for lead coupled with the understanding that Reference Dose (RfD) methodologies are basically route-specific and do not incorporate site-specific information has led EPA to withdraw the RfD for lead. The EPA Environmental Criteria and Assessment Office (ECAO) has suggested instead the use of an uptake/biokinetic modeling approach to develop health criteria for lead (U.S.EPA 1989b).

Many considerations have gone into the documentation of a lead soil clean-up level for the NL/Taracorp Superfund site. The first was the inability to find a suitable basis on which to perform a risk assessment based on dose-response relationships given the withdrawal of the RfD for lead. The second was the EPA Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites (OSWER Directive # 9355.4-02, 1989). This directive sets forth an interim soil clean-up guideline for total lead in soil at 500 to

1,000 ppm. However, it also allows that "site-specific conditions may warrant the use of soil clean-up levels below 500 ppm or somewhat above the 1000 ppm level". This latter guidance was used to evaluate the conditions at the NL/Taracorp Superfund site.

A number of factors have influenced the setting of a lead soil clean-up level for the NL/Taracorp site.

1) The soil at the NL/Taracorp (Granite City) site has been documented as containing elevated levels of lead (Remedial Investigation Report 1988).

2) Smelter operations are known to result in the emission of small aerosol particles which stay airborne and travel over an extensive area (Steele 1989). Because the lead deposits at the NL site originated from air emissions from smelting operations, the resulting discharge was as fine particles having a wide area of distribution and deposition. (This area has not been fully delineated and further soil testing will be needed to determine the extent of the area contaminated by lead emissions from the NL Industries operations.)

3) The small particles deposited in the soil can cling to skin, clothing and children's toys and can be transferred into the indoor environment as windborne dust or carried in on the shoes or clothing of residents or the fur of household pets.

4) The small lead particles have high bioavailability, due to their easy dissolution in the stomach and the chemical form of the lead salts.

5) Even low exposures to lead have been shown to have significant health effects on developing children, especially those under the age of six years.

6) Children who show tendencies toward frequent mouthing activities can ingest large amounts of soil and indoor dust and hence, large amounts of lead

(Calabrese 1989, Binder 1986). Those who are nutritionally compromised and/or exhibit pica might be at risk for severe health effects.

7) The area of Granite City most affected by the smelter emissions is highly residential and contains a significant number of young children - the subpopulation known to be the most sensitive to the toxic effects of lead.

8) Granite City and the surrounding area is highly industrialized and residents are likely to be exposed to a complex mixture of toxic substances in the air and in the soil, which may act to increase the toxic effects of lead in a synergistic manner. The assessment of health risks from chemical mixtures is of growing concern to EPA (FR 50 1985).

These factors indicate that there is a high possibility of adverse health effects in young children living in the Granite City areas impacted by the NL/Taracorp Superfund site. Accordingly, a soil lead clean-up level of 500 ppm was deemed necessary if this subpopulation is to be fully protected.

This lead soil clean-up level is consistent with the approach being taken for similar contaminated sites in other countries, other Regions in the U.S., and is advocated by researchers examining lead toxicity in pediatric populations. In a report to the Ontario Minister of the Environment by their Lead in Soil Committee, the committee responded to the request that they review the available literature on lead in soil and recommend "scientifically defensible" soil removal guidelines for lead-contaminated soil (OLSC Report 1987). The committee recommended that a 1000 ppm guideline level is appropriate for areas to which children do not have routine access, while a guideline level between 500 and 1000 ppm is appropriate for areas to which children do have routine access. The comments of the Royal Society of Canada were also included in the report. They recommended that for clean-up around

lead-processing or lead-using plants, soil lead levels of up to 500 micrograms per deciliter are acceptable for residential areas and for garden and allotments, while levels of up to 1000 ppm should be acceptable for parklands and other areas to which children have only intermittent access. Similiar conclusions have been reached in the U.S. regarding the soil clean-up at lead smelter sites; lead soil clean-up levels in such impacted residential areas in Regions I, II and VIII have recently been set at 200 to 500 ppm. These are also the conclusions being echoed by researchers in the field. Milar and Mushak (1982) warned that a definite health hazard exists to children when household dust levels exceed either 1000 ppm or 50 micrograms per square meter. Mielke et al. (1989) summarized the work of a number of researchers addressing the question of the safe lead concentration in soil to protect children from undue exposure with the conclusion that a rapid rise in population blood lead levels takes place when the lead content of soil increases from less than 100 ppm to 500-600 ppm. Dr. Mielke has stated in a personal communication that he believes the safe lead soil level in areas contaminated with fine lead particles to be between 200 and 250 ppm. A study by Shellcheer et al. (1975) in New Zealand concluded that children exposed to more than 100 ppm lead in soil and who also exhibit pica are at major risk to lead exposure.

The site-specific conditions presented earlier led Region V to consider the use of a modeling approach to further evaluate the lead soil clean-up level proposed for this site. This approach is consistent with the recent comments received from NL Industries that the incorporation of the Biokinetic Model and other generic and site-specific data into the development of clean-up levels for lead are appropriate (NL Industries comment to the

public response, Exhibit A). The letter from Dr. Krablin, Manager for Environmental Projects, ARCO, included in Exhibit A defends the EPA Integrated Uptake/Biokinetic Model as having been "demonstrated to be a reliable analytical method to determine the relationship between environmental lead concentrations and blood lead concentrations for EPA lead rulemaking". The EPA Office of Research and Development has examined several other modeling approaches, including a lead soil matrix model proposed by the Society for Environmental Geochemistry and Health (SEGH) Task Force on Lead in Soil, and has indicated that the favored approach is the Biokinetic Model. Two recent technical support documents have been issued which present the rationale for this modeling approach for developing health criteria for lead (USEPA 1989b, USEPA 1989c). The Biokinetic Model provides a means for incorporating either site-specific or internationally consistent default assumption values regarding exposure scenarios and absorption efficiencies for lead uptake from various media into the exposure analysis to yield estimates of the relative contributions of air, dietary and soil lead to the total estimated lead uptake.

When site-specific data collected in Granite City and soil lead/dust lead levels of 500 ppm and 1,000 ppm were input into the Lead Uptake/Biokinetic Model, the graphs presented in Figures 1 and 2 were obtained. Figure 1 uses the 500 ppm soil lead/dust lead level, soil ingestion rates of 0.100 grams per day as suggested by O'Brien & Gere rather than the default Calabrese data, air lead levels taken from the Remedial Investigation Report, and default values as listed from the Users Guide for Lead: A PC Software Application of the Uptake/Biokinetic Model. No pica was considered; lead in paint was considered not to be available for ingestion (painted surfaces in

good condition). An U.S. average water lead level was included to account for the contribution from lead in plumbing. The model predicted the mean blood lead level for children under the age of six to be 8.37 micrograms per deciliter, with approximately 8.5 percent of the children predicted to attain blood lead levels greater than 15 micrograms per deciliter. When a soil lead/dust lead level of 1,000 ppm was substituted into the model, approximately 34 percent of the children were predicted to have blood lead levels greater than 15 micrograms per deciliter. This would put 34% of the Granite City children above a level which may represent a risk of adverse health effects. It is notable that the model shows that for most ages, the soil/dust lead intake is greater than 29 micrograms per day while the lead intakes from air and water are nonsignificant. The model also shows that the 500 ppm soil clean-up level appears to be appropriate because further reductions in food lead levels are anticipated due to the removal of lead-containing soils, to education of residents on ways to reduce lead intake in children provided by the U.S. EPA and IEPA, and to the possible impact of reductions in allowable releases of lead to the air and in the water expected from changes to the National Ambient Air Quality Standard and the National Primary Drinking Water Regulations later this year.

In conclusion, EPA Region V has set a 500 ppm lead soil clean-up level at the NL/Taracorp Superfund site. It is the best professional judgement of the staff that this level represents the minimum soil clean-up level which can be expected to protect the most sensitive Granite City residents, children under the age of six years.

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TABLE 1

Summary of Lowest Observed Effect Levels For Lead-Induced Health Effects in Children and Adults

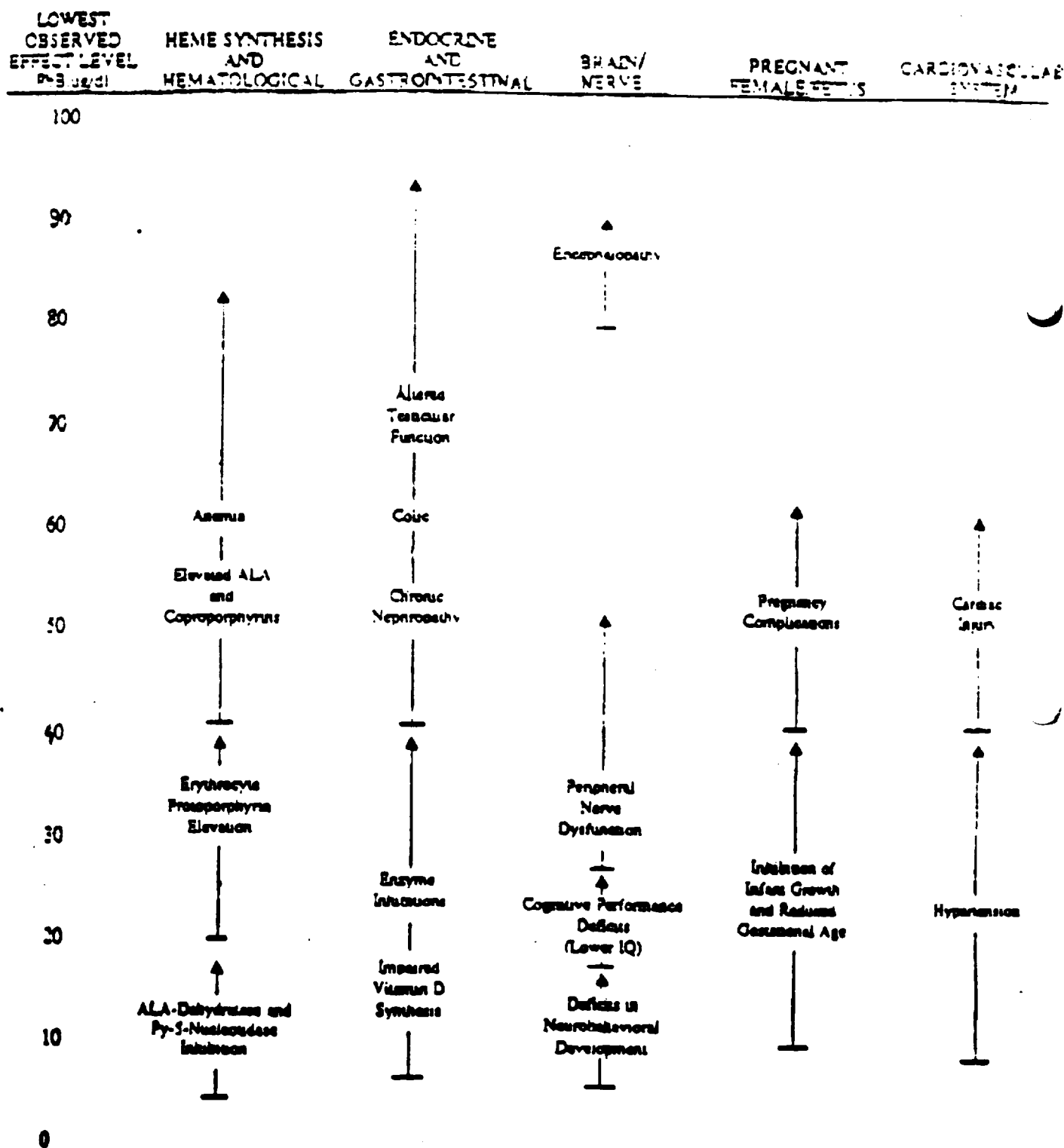


TABLE 2
SUMMARY OF RECENT STUDIES ON THE ASSOCIATION OF
PRENATAL LEAD EXPOSURE WITH SELECTED FETAL OUTCOMES⁽¹⁾

Reference	N	PbE Source		Gestational Age	Birth Weight
		Source	Average ug/dl		
Ernhart et al. (1985a, 1986)	185 162	maternal del. cord	6.5 5.5	0 0	0 0
Bollinger et al. (1984)	216	cord	6.5	+	- ^a
Needleman et al. (1984)	4354	cord	6.5	0	0
Bernstein et al. (1989)	202	maternal/pre	7.0	0	- ^a
Dietrich et al. (1989)	183	maternal/pre	8.3	- ^a	- ^a
Wolf et al. (1987)	182	infant post-natal	10.3		- ^a
McMichael et al. (1986)	749	maternal del. cord	11.0 10.1	- ^a - ^a	+ +
Moore et al. (1982)	236	maternal del. cord	14.0 g.m. 12.0 g.m.	- ^a - ^a	0 0
Rothenberg et al. (1989)	51	maternal/pre maternal/del cord	15.0 15.4 13.8	0	- ^a
Graziano et al. (1989)	907 639	maternal (prospect.) maternal (retrosp.)	17.1 g.m. 15.9 g.m.		0 0 ^b
Ward et al. (1987)	100	placental Pb	2.35 pg/g	-	- ^a

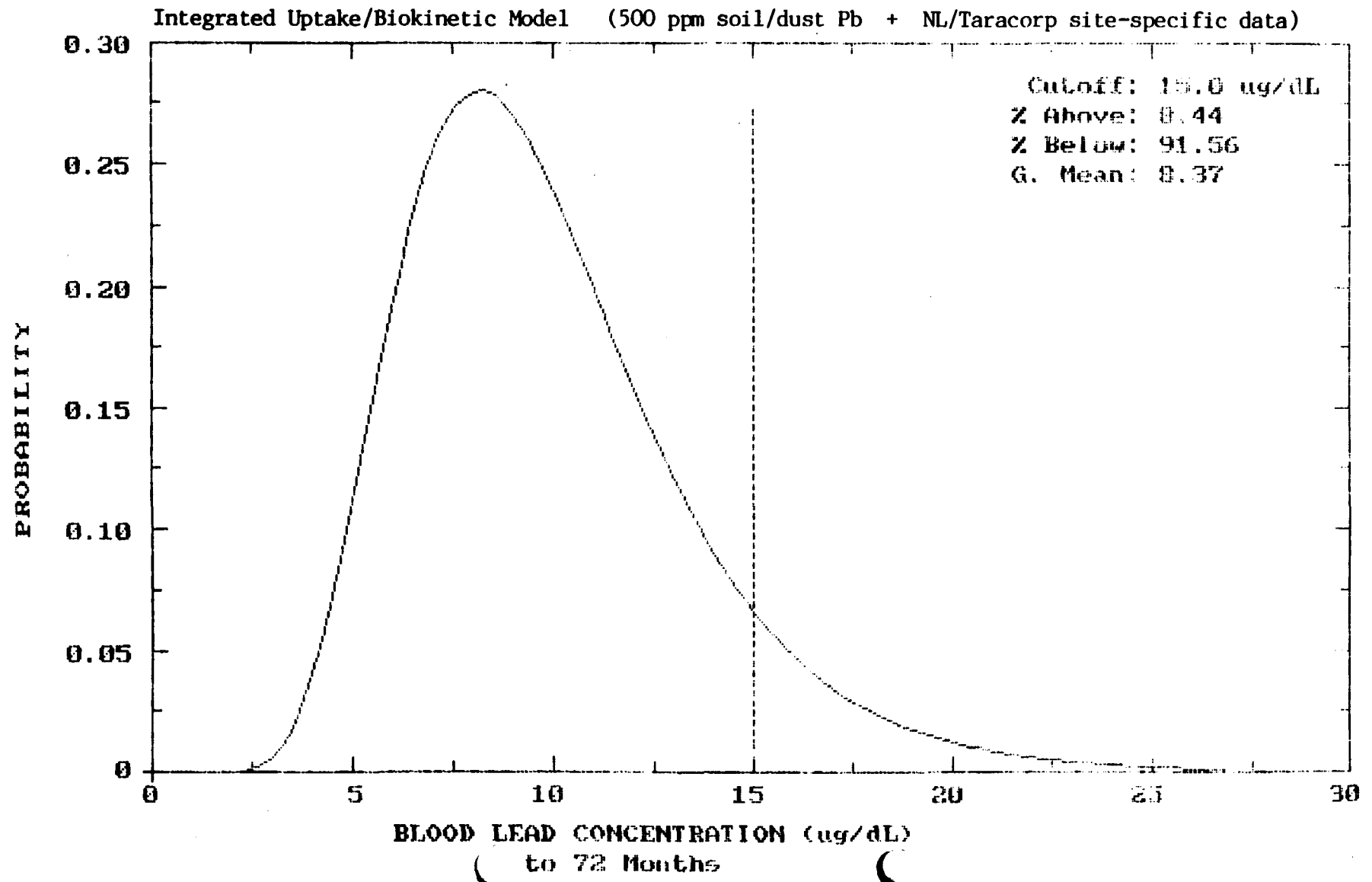
Symbols: 0, no evident relationship; +, positive relationship; -, negative relationship; *, statistically significant at $p < 0.05$; g.m., geometric mean.

^aBirth weight showed no relationship, but the trend in percent of small-for-gestational-age infants was nearly statistically significant at $p < 0.05$.

^bRate of spontaneous abortions.

⁽¹⁾From: U.S. EPA 1989a.

Figure 1



Air Concentration: 0.260 ug/m3

Diet: DEFAULT

Drinking Water: 8.88 ug/L DEFAULT

Soil & House Dust: Values entered by user.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	500.0	500.0
1-2	500.0	500.0
2-3	500.0	500.0
3-4	500.0	500.0
4-5	500.0	500.0
5-6	500.0	500.0
6-7	500.0	500.0

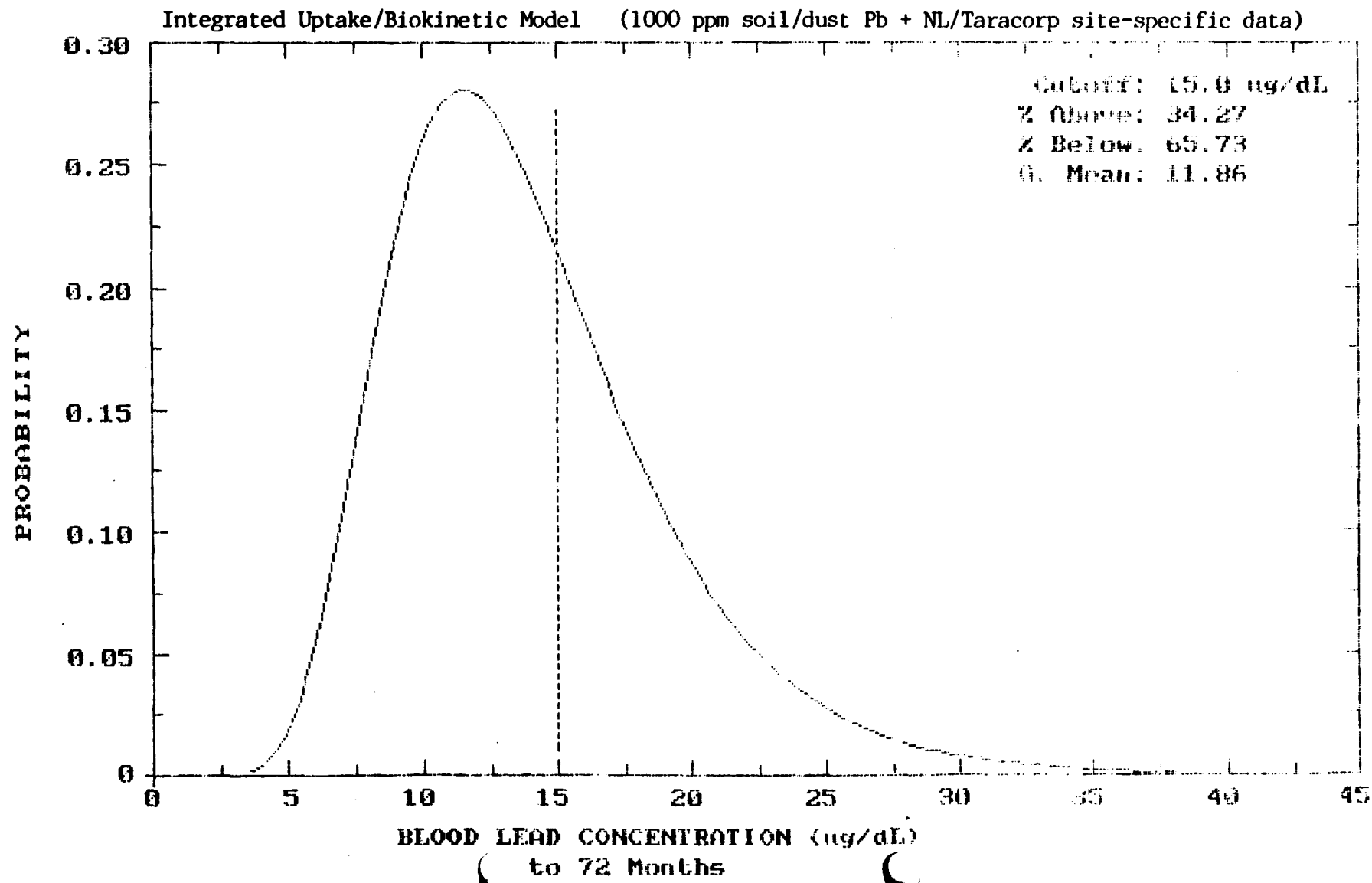
Additional Dust Sources: None DEFAULT

Paint Intake: 0.00 ug/day DEFAULT

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	5.13	15.73	3.75
1-2:	7.50	30.42	14.99
2-3:	8.78	32.04	14.99
3-4:	9.22	32.24	14.98
4-5:	9.66	32.54	14.97
5-6:	9.83	33.57	14.96
6-7:	10.01	35.08	14.95

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	10.93	0.89	0.00	0.16
1-2:	12.96	2.22	0.00	0.25
2-3:	14.33	2.31	0.00	0.41
3-4:	14.49	2.35	0.00	0.41
4-5:	14.71	2.44	0.00	0.41
5-6:	15.45	2.58	0.00	0.57
6-7:	16.94	2.62	0.00	0.57

Figure 2



Air Concentration: 0.260 ug/m3

Diet: DEFAULT

Drinking Water: 8.88 ug/L DEFAULT

Soil & House Dust: Values entered by user.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	1000.0	1000.0
1-2	1000.0	1000.0
2-3	1000.0	1000.0
3-4	1000.0	1000.0
4-5	1000.0	1000.0
5-6	1000.0	1000.0
6-7	1000.0	1000.0

Additional Dust Sources: None DEFAULT

Paint Intake: 0.00 ug/day DEFAULT

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	6.21	19.48	7.50
1-2:	10.68	45.33	29.90
2-3:	12.88	46.88	29.83
3-4:	13.47	46.98	29.73
4-5:	14.07	47.16	29.60
5-6:	14.20	48.04	29.44
6-7:	14.27	49.38	29.24

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	10.93	0.89	0.00	0.16
1-2:	12.96	2.22	0.00	0.25
2-3:	14.33	2.31	0.00	0.41
3-4:	14.49	2.35	0.00	0.41
4-5:	14.71	2.44	0.00	0.41
5-6:	15.45	2.58	0.00	0.57
6-7:	16.94	2.62	0.00	0.57

9. VALUES of DEFAULT PARAMETERS

The values of the default parameters which can be changed by the user are as follows:

Air Data: Air Concentration: 0.20 $\mu\text{g Pb}/\text{m}^3$
Lung Absorption: 31.5%
Vary Air Conc by Year: NO
Ventilation Rate
Age 0-1: 2.0 m^3/day
1-2: 3.0 m^3/day
2-3: 5.0 m^3/day
3-4: 5.0 m^3/day
4-5: 5.0 m^3/day
5-6: 7.0 m^3/day
6-7: 7.0 m^3/day

Water Data: Water Concentration: 8.88 $\mu\text{g}/\text{l}$
Use Alternate Values: NO
Water Consumption
Age 0-1: 0.20 l/day
1-2: 0.50 l/day
2-3: 0.52 l/day
3-4: 0.53 l/day
4-5: 0.55 l/day
5-6: 0.58 l/day
6-7: 0.59 l/day

Diet Data: Use Alternate Values: NO
Diet Intake
Age 0-1: 21.86 $\mu\text{g Pb}/\text{day}$
1-2: 25.94 $\mu\text{g Pb}/\text{day}$
2-3: 28.71 $\mu\text{g Pb}/\text{day}$
3-4: 29.05 $\mu\text{g Pb}/\text{day}$
4-5: 29.53 $\mu\text{g Pb}/\text{day}$
5-6: 31.10 $\mu\text{g Pb}/\text{day}$
6-7: 34.26 $\mu\text{g Pb}/\text{day}$

Soil & Dust Data: Use Alternate Dust Values: NO
Calculation: Amount Ingested Daily
Age 0-1: 0.005 g/day
1-2: 0.050 g/day
2-3: 0.200 g/day
3-4: 0.200 g/day
4-5: 0.050 g/day
5-6: 0.050 g/day
6-7: 0.050 g/day

$\bar{x}_{0-7} = 0.086 \text{ g/day}$ } Use:
0.100 g/day
age 9mo-7y.

Paint Data: Amount Ingested Daily: 0.0 $\mu\text{g Pb}/\text{day}$ (all ages)

Graph Values: GSD: 1.42
Cutoff: 10 $\mu\text{g Pb}/\text{dl}$